AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

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AUGUST 1983
AUST $2.10* NZ $2.60

TOUCH LAMP TIMER

DIGITAL FREQUENCY METER

COMPUTER MUSIC SYNTHESISER

VIDEO AMPLIFIER for computers and VCRs

THERMAL SHOCK– new nuclear hazard?

SONY
THE ONE AND ONLY

The Sony CDP101
The magic of digital audio becomes a magnificent reality.

Digital Audio is a revolution. The greatest advance in home music reproduction since the gramophone record. As you'd expect, Sony is the leader of this revolution with its magnificent CDP-101 player that offers you original studio master quality at home.

For the technically minded, the specifications read more convincingly than any superlatives • flat frequency response over the entire audible range • dynamic range and signal to noise ratio over 90dB • perfect channel separation • immeasurable wow and flutter • negligible distortion.

Sony's CDP-101 uses an optical laser pick-up (incorporating three micro processors), it is easier to use than a conventional turntable and connects easily to your existing system.

Other features include • fully automatic linear skate front disc loading • automatic music sensor • dual function digital readout of playtime • audible fast forward and reverse • 10 function wireless remote control.

Compact Discs Last Forever

Just 12 cms in diameter, the Compact Disc plays up to 60 minutes of music. It's protected from scratches, dust and finger prints by a plastic coating; and because the pick-up is a laser beam, deterioration is non-existent. Reproduction remains perfect virtually forever.

Hundreds of titles will be available with many more to follow from major companies such as CBS.

CDP-101 Specifications

Frequency Range	5Hz-20kHz ± 0.5dB
Dynamic Range	more than 90dB
S/N	more than 90dB
Channel Separation	more than 90dB (at 1kHz)
Harmonic Distortion	less than 0.004% (at 1kHz)
Wow and Flutter	immeasurable

Contact Sony for the name of your nearest dealer.
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AUD0378

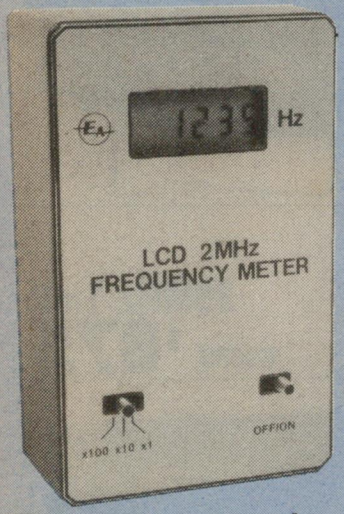
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 45, No 8, August, 1983

On the cover

Highlighted on the cover is our touch lamp timer, which combines the convenience of touch control switching with a delay circuit to turn on a lamp or other appliance for a preset period. Details on page 52.



Frequency counter

Featuring a 4½-digit LCD,, this new digital frequency meter is battery powered and can measure frequencies up to 2MHz. It uses the LCD Event Counter described last month and is easy to build and get going. Details p78.

Sound effects and music for your computer

See article p.90

Video amplifier

Bothered by smeary colours and interference on your computer display? Throw away that nasty RF modulator and use our video amplifier to make a direct video connection to your TV set instead. Construction starts on p62.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

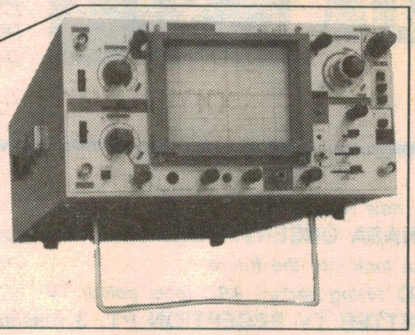
Departments

THINKING ABOUT BUYING A SCOPE?

FOR PERFORMANCE & VALUE AARON HAS TO BE YOUR FIRST SCOPE CHOICE

All these scopes are dual trace and incorporate the latest features such as high brightness rectangular CRTs.

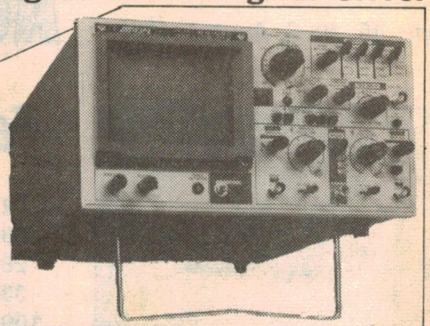
SIGNAL AND TIMEBASE DELAY



- 7.7nS risetime
- Single sweep
- Trigger delay
- TV sync
- X-Y, dual, chop, add, subtract etc.

45MHz/1mV
BS625 $1095

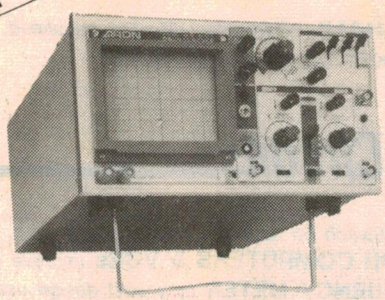
ALTERNATE AND DELAYED TIMEBASE



- 21 range timebase
- 100mS-1 μS trigger delay
- Front panel trace rotate
- X-Y, dual, chop, add, subtract etc

35MHz/1mV
BS635 $875

BUILT-IN COMPONENT TESTER



- Check components on screen
- 19 range timebase
- Triggerable to over 30MHz
- 17nS risetime

20MHz/5mV
BS601 $535

BATTERY PORTABLE

- 2 hour operation from built-in NiCad battery
- Automatic recharging
- Auto trigger free run
- TV sync

15MHz/2mV
BS310 $795

COLINE SP100 PROBE

Professional 100MHz probe offering x1, ref, x10 positions. 1.5m lead with BNC connector and selection of tips. Complete in heavy duty plastic pouch. **$28**

QUICK SPEC CHECK

AARON

MODEL	B'WIDTH	SENS	SIG DEL	TRIG DEL	SCREEN	T'BASE
625	45MHz	1mV	Y	Y	150mm	0.2uS - 0.5S/div
635	35MHz	1mV	N	Y	150mm	0.1uS - 0.5S/div
601	20MHz	5mV	N	N	150mm	0.5uS - 0.5S/div
310	15MHz	2mV	N	N	95mm	0.5uS - 0.5S/div

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Editorial Viewpoint

No collapse likely for computer market

Recent developments in the computer market in the United States have led some commentators to state that a total collapse is imminent. Some readers may even be wondering if we are going to see a repeat of the CB boom and collapse of a few years ago repeated with computers.

Our short answer to that question is "no". The two situations are not really similar at all. Certainly a number of companies in the USA have grossly over-estimated their sales for 1983 and, as a result, some personal computers can presently be purchased very cheaply, with the outstanding examples being the Timex 1000 (known here as the Sinclair ZX81) available at under $30 and the Texas TI-99/4A for around $100.

But while collapse may seem imminent with these prices, we think it is only a temporary hiccup in the long term trend whereby personal computers will continue to become cheaper. One does not have to be prescient to predict that the $10 pocket computer will shortly be at hand. So while some US companies and dealers may presently be severely threatened and may pull out of computers, there is little danger of total collapse.

There is even less danger of a spillover to the Australian market with goods that cannot be sold in the US. Most US-made computers cannot be used in Australia without some modifications and those with colour displays are not compatible with our PAL TV system. That is partly why some of the big US companies have been slow to make inroads into the Australian market.

Luckily also for the companies involved in the Australian market, the Japanese have yet to really make their mark in personal computers for home use, although some of their small business machines have been outstanding. So whereas in the CB boom and collapse the Japanese manufacturers were able to divert their production from the USA to Australia, there is no prospect of that happening with computers.

We may yet see some price reductions in computers on the local market over the next few months but there is little chance of an all-out price war with the spoils going to the buyers.

In a way it is good to see that the US market is experiencing a shake-up. Perhaps this will lead to a reassessment of the role of personal computers in the home and businesses. It should also lead to the development of more useful software, rather than the present flood of games and near-useless "educational" programs.

"Faster" amplifiers are a myth!

There is no doubt that selling high fidelity equipment these days is tough and competitive and so companies go to any lengths to promote a special feature or quality of their product. The latest one I've heard is that some amplifiers sound "faster" than others which may have a higher slew rate limit. Apparently this "fast" quality is somehow connected with a low power supply output impedance. Now I'll admit that the power supply should not drop its bundle when called upon to deliver but the idea of "faster" amplifiers is pretty hard to swallow.

Leo Simpson

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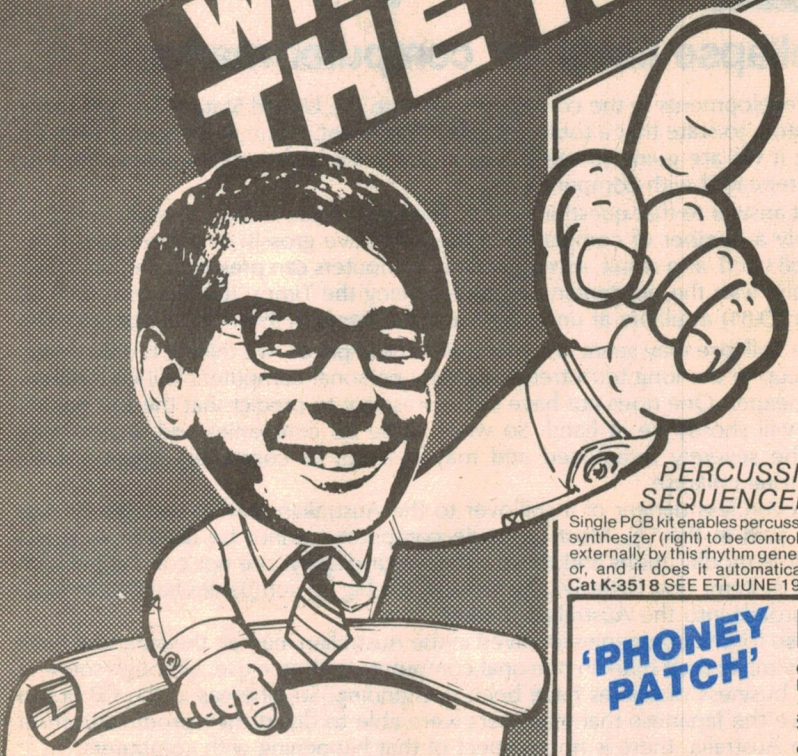


NEW

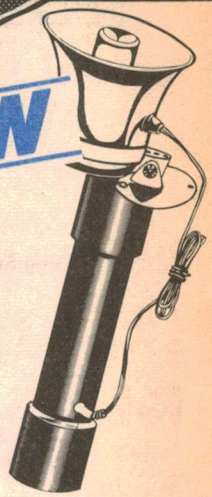
See August ETI

Loud Hailer

A great new kit for the kids - their own loudhailer! With exclusive detachable horn for minimising feedback, battery holder/handle, amplifier and mic module, it's so easy to build and it really works well! (Horn can be remotely connected too).

Cat K-3507

Top value at only **$29.95**



CHEAP INSURANCE FOR YOUR SPEAKERS!

Our speaker protector is a time delay circuit which delays connection at turn on and removes it at turn off. Easy to build and suits most amps. **Cat K-3425** SEE EA MAY 1976 **$9.50**

PERCUSSION SEQUENCER

Single PCB kit enables percussion synthesizer (right) to be controlled externally by this rhythm generator, and it does it automatically! **Cat K-3518** SEE ETI JUNE 1982 **$12.50**

PERCUSSION SYNTHESIZER

Produces the sound of drums, cymbals, snares and bongos. You can play manually or by total electronic control. Add a sequencer, and you can have automatic rhythm. **Cat K-3517** SEE ETI MARCH 1982

AMAZING VALUE **$47.50**

'PHONEY PATCH' Landline Interface

Get ready for Phone Patching when it's made legal - this great little kit is ideal for connecting a four wire (eg. transmitter/receiver) system to a two wire (eg phone lines or intercoms, etc). You could even set your transmitter up for complete remote operation using VOX. **Cat K-3054** SEE ETI MAY 1983

INCREDIBLE VALUE **$59.50**

HOBBYISTS Dick Smith Prototyper

Just the thing for lashing up circuits, experimenting with values trying out ideas, modifications, etc. Gives various supplies, a variable frequency signal, debounced switches, indicators, etc. What an amazing device! **Cat K-3465**

SEE ETI JULY 1982

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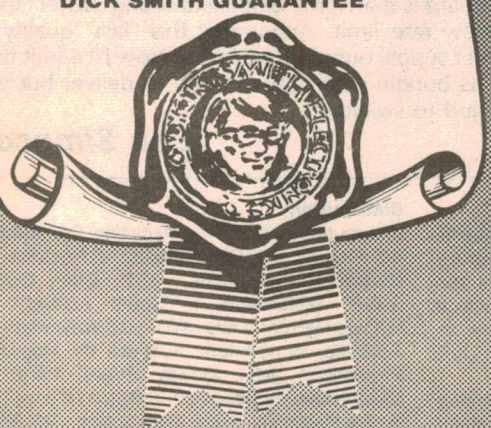
Don't miss out on these DICK SMITH BENEFITS:

- Instructions for all kits are written by professionals, in easy to understand language.
- Kits are laboratory tested to prove that they actually DO work and all components are thoroughly checked by our Quality Control Department.
- We are proud of our kits. We have built our reputation based on their quality and back every kit we sell with our exclusive 7 day satisfaction guarantee.

That's the DICK SMITH GUARANTEE



Don't be conned into paying extra for your kits - ours are guaranteed top quality and include special parts the others make you pay extra for!

SAVE

Joystick Interface Kit & The Quickshot Joystick Now For The One Low Price!

Calling all System 80 owners: isn't it a pain in the neck using the arrow keys to play games? Wouldn't you rather use a Joystick control? Here's your chance! This kit allows you to add a joystick to your System 80 via the printer port - and here's the good news: Now we're INCLUDING THE 'QUICKSHOT' JOYSTICK with the Interface Kit for the one low price! This fantastic joystick features contour grip and rubber suction cups to hold it down. It's just like the real one in a helicopter. Suits VIC and Atari, or System 80. **Cat K-3455**

Kit & Joystick for only **$49.50**

A551/CT

BUILD YOUR OWN TEST GEAR — SAVE A FORTUNE!

Measure the value of new & used components

R-L-C Bridge

You can measure resistance, (10 ohms to 10 Megohms), capacitance (10pF to 10uF) and inductance (down to a few hundred microhenries). The RLC bridge does more than a multimeter, and is easy to use. The complete kit of parts includes a specially printed front panel. Battery not supplied. **Cat K-3468**

SEE EA MARCH 1978

build yourself for only **$37.50**

build your own

Sine & Square wave Oscillator

Covers frequencies from 15Hz to 150kHz. This is one of the most useful pieces of equipment on the experimenter's bench. The simple design is easy to build and a great performer. Runs from a 9V battery. All parts are supplied, including specially printed front panel, attractive 'Zippy' case and full instruction. Battery not included. **Cat K-3469**

SEE EA JUNE 1978

ONLY **$37.50**

Turn your old TV into a CRO!

Turn your old B&W TV into an audio CRO! That's right: this remarkable kit turns any surplus B&W (or even surplus colour) TV set into a 300kHz audio oscilloscope! It gives a good display at low frequencies, making it ideal for hi-fi & audio display applications. All it needs is 100mV to drive it to full screen deflection. If you can't afford a pre-built CRO - this could be the answer! **Cat K-3060**

SEE EA MAY 1980.

Yes, your own CRO for ONLY **$29.95**

A CASINO IN YOUR LOUNGEROOM!

Wow! All the fun & excitment of Las Vegas... Wrest Point... even Forbes St. Now you can have a completely random roulette wheel - without the bias of commercial units! **Cat K-3389**

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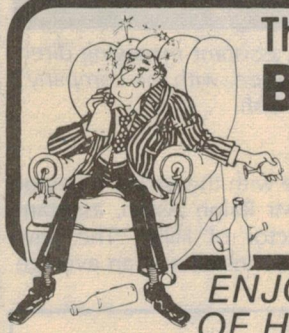
ELECTRONIC Roulette Wheel

AMAZING VALUE AT **$29.50**



The not so random Breath Tester

Beware boys in blue and booze buses bailing belligerent Brabhams blowing bad breath into bags before banning. Check out our breath tester kit - it could be the answer to your broblems! **Cat K-3391**

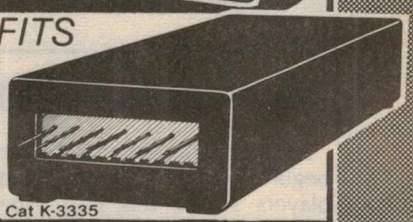
ONLY **$29.95**

Not a legal check!

ENJOY THE BENEFITS OF HEALTHY IONS

You've heard all about Negative Ion Generators and their benefits, now buy the kit and find out what it's all about. Many commercial units run from the mains, but our kit is safe - it runs on 12V DC, which also means that you can put one in your car!

SAVE ON A BUILT UP UNIT ONLY **$38.50**



Cat K-3335

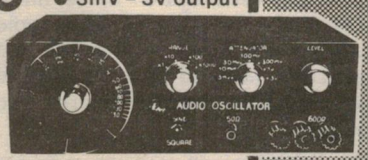
Low distortion Audio Oscillator

- 15Hz - 150kHz
- 3mV - 3V output

Uses the characteristic low noise of a VMOS device to give an ultra-low distortion output. All the components mount on a single PCB and construction is really quite straightforward. **Cat K-3467**

ONLY **$67**

SEE EA JUNE 1981



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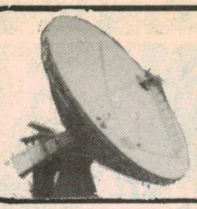
See page 98 for full address details

AUSTRALIA'S LARGEST KITS SUPPLIER!



News Highlights

Satellite ground station for outback TV

Australia's outback citizens are due for a better deal, in regard to TV programs, following a major development exercise by the electronics firm Hills Industries of South Australia. The company has developed a new 3.7m fibreglass parabolic dish antenna, which will be much cheaper to buy and install than the reflector panel and horn assembly it is to replace. (See "Electronics Australia", August 1981.)

The fibreglass dish has been designed to receive the 4GHz channel from Intelsat IVA, used for relays of the ABC under the Remote Area Television Program, but can accept frequencies up to 12GHz, which would make it suitable for the Australian domestic satellite, currently planned to go into service in 1986.

The first of the new fibreglass dish systems has been installed at the Travel Lodge Hotel in Port Moresby. The hotel management is said to be delighted with the reception from the system, and Hills has had orders from 30 other people in Papua New Guinea as a result of the installation.

Hills Industries assistant managing director, Mr Ralph Aston, with the company's new parabolic dish.

"The advantages of the fibreglass dish are that it is cheaper, lighter, more efficient on a size for size basis and it doesn't require trained crews to install, as was the case with the earlier reflector panels," says Mr Ralph Aston, assistant managing director of Hills. "The new system is easy to install and an average handyman will be able to put it up within a few hours by following the instruction booklet."

The earlier Hills Telesat system cost about $7000 installed in outback locations, but the new model will sell for around $4500 on an install-it-yourself basis. "In the case of small outback communities", says Mr Aston, "it is relatively easy to connect the system to several houses by coaxial cable, which means the cost can be spread among a number of families.

"One of the problems we had to overcome was the fact that fibreglass itself is not electrically reflective and we had to build reflectivity into it, whilst retaining an accurate parabolic shape and ensuring that the reflective material was protected from the elements," said Mr Aston. "Our dish is very strong and can stand high winds and harsh weather conditions."

Meanwhile, Toshiba has announced that it will be supplying equipment for reception of transmissions from the Australian domestic satellite. A basic receiver dish for 12GHz will cost around $1000, according to the company. These dishes are not suitable however for reception of the lower frequency ABC satellite relays being used at present.

Japanese launch for VHD video disc system

Seven Japanese manufacturers have begun shipments of VHD video disc players so far this year. The VHD system players use a grooveless capacitive pick-up system which is said to be cheaper to manufacture than laser disc players while still providing the same special effects and random access capabilities.

Since Pioneer began sales of its optical laser disc players in Japan in October 1981, some 50,000 players have been sold. This year sales of about 70,000 are predicted. The seven companies supplying VHD players claim that their format will sell from 100,000 to 150,000 units this year, bringing total sales for both formats to over 200,000 in 1983.

The Victor Company of Japan (JVC) was the first company to put its VHD video disc player on the market, following two postponements and a lapse of five years since the system was first announced. The "Disk World HD-7500" is a front-loading player providing a playing time of one hour on each side of the disc. Chapter search and time search at 60 times the normal playing speed allow rapid access to any point on the disc and stop action, fast and slow motion and repeat picture functions are also available.

The HD-7500 sells for about $A710 and production of 5000 units per month is planned.

Sharp Corporation has also begun sales of its "My Disk VP-1000" player, priced at $A620, along with an optional random access playback and control unit which can be connected directly to most personal computers.

IBM says "yes" to computer project

Further to our story last month on "fifth generation" computers it has now been announced that International Business Machines (IBM) has asked to join the Japanese government-sponsored research project.

The Japanese believe that by combining high speed parallel processors with the latest artificial intelligence research results, they can produce a computer which can perform many hundreds of thousands of "logical inferences" per second, mimicking human thought processes.

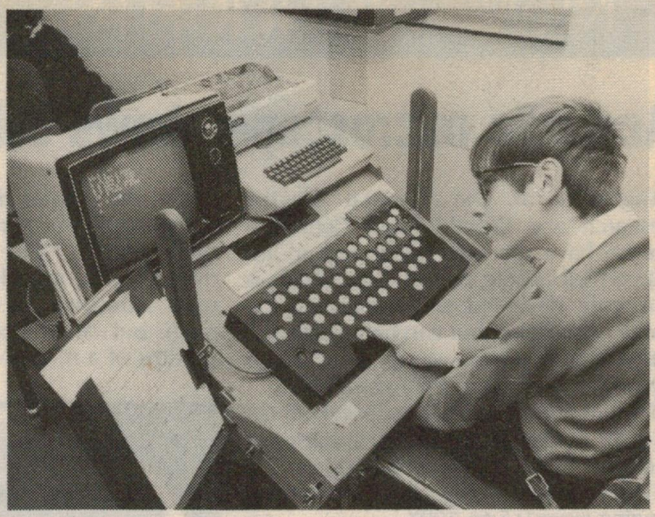
As discussed last month, Fujitsu, Hitachi, NEC, and five other Japanese companies are already taking part in the project and several European computer manufacturers have shown interest in participating. The planned 10 year project could become the largest international research effort in history.

Computer keyboard for handicapped children

From Britain comes news of a new development which opens up the world of computers to the handicapped. One hundred and fifty handicapped children at the Charlton Park School in London are learning that a physical handicap is no barrier to mastering computer skills, thanks to Apple computer systems which serve as both educational tools and versatile writing and drawing machines for communicating with friends.

Special keyboards are fitted to enable them to be operated by children who are unable to cope with the standard controls. Charlton Park is also used as a Special Resources Centre where microelectronics equipment and other facilities for the handicapped are tested for use in other schools throughout the London area.

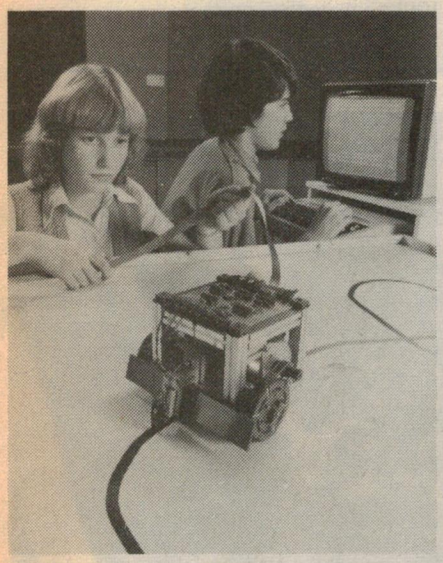
The development of computer education for the disabled is part of a nationwide drive to increase knowledge and uses of microelectronics in all British schools. The Government's Microelectronics Education Program has already been funded to the £20 million since 1980, and is now to be extended to until 1986.



Computer communication – an invaluable aid for this child who can neither write nor speak.

For further information contact Inner London Education Authority, The County Hall, London SE1 7PB, UK.

Robot Buggy!



This new robotic vehicle, the "BBC Buggy", is designed to provide children and adults with a stimulating introduction to the topics in computer control technology.

The "Buggy" has been developed for use with the BBC microcomputer, and has three wheels, two of them driven by stepping motors. It is equipped with detectors which enable it to seek out light sources and avoid obstacles in its path and incorporates an infrared bar-code scanner to simplify the loading of instructions.

A series of 13 programs are supplied with the vehicle, to provide capabilities for following and memorising a given route, planning paths of travel and working out the dimensions of objects for later transfer to the controlling computer. By reading in information from bar-codes, the buggy can even play music, and a pen drawing mechanism and a robot arm are available as options.

Although the Buggy was primarily developed for use with the BBC microcomputer, the manufacturers of the buggy, Economatics Ltd, plan to develop an interface so that it can be used with other computers.

Optical fibres to link Europe & North America

Optical fibres, as practical communication devices, have come a long way since the first experimental transmissions, over a few kilometres, only a few years ago. Plans are now well in hand for the first transatlantic optical fibre submarine telephone cable system.

The cable, known as TAT-8 (the eighth transatlantic telephone cable) is due to come into operation in 1988 and will be the longest fibre optic link so far attempted. It will be owned and operated by a consortium of 28 national telecommunications authorities and commercial companies.

TAT-8 is needed to meet the continuing massive growth in calls between the two continents – in particular between the USA and Britain, by far the world's busiest transoceanic telephone route with 30 million calls a year.

The cable will have two pairs of fibres, each pair operating digitally at 280 million bits a second (280 Mbit/s). The cable will have a basic capacity of 8000 simultaneous phone calls. This can be increased up to five times by digital circuit multiplying equipment.

Tenders from Submarcom (France), Standard Telephones and Cables Ltd (UK), and AT&T of the United States are now being evaluated.

Further development for bionic ear

The Minister for Science and Technology, Mr Barry Jones, has announced that a further $2 million is to be expended to develop the implantable hearing prosthesis ("bionic ear") through clinical trials and into commercial production. The Department of Science and Technology will provide approximately 75% of the amount, while the rest will come from Nucleus Ltd, the NSW based biomedical technology group that is conducting the trials.

The clinical trials will bring the project to the stage of determining its suitability for world marketing. The United States is the main export market for the device, and it is necessary to prove the safety and efficiency of any such product to the satisfaction of the US Food and Drug Administration.

In earlier trials, six patients were implanted with the device at the Royal Victorian Eye and Ear Hospital with encouraging results. In one case, a patient who was totally deaf regained sufficient hearing to use the telephone!

The new trials are expected to take about 18 months, with the device being commercially available by the mid-1980s.

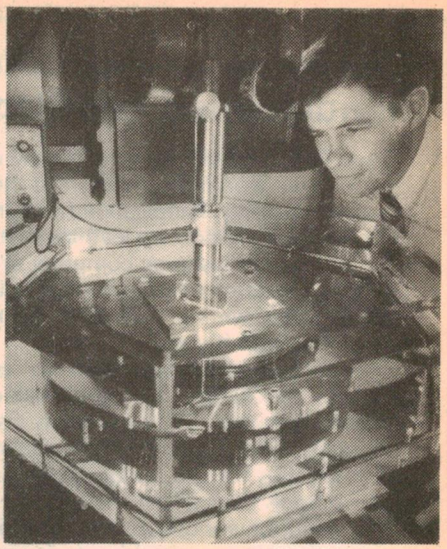
Acoustic microscope shows solder flaws

Engineers at the General Electric Research and Development Centre in the US have recently developed an advanced ultrasonic testing unit which is not only designed to handle a wide range of samples, but can be adjusted to penetrate very thick samples or locate very small defects in thinner samples.

The instrument can handle cylindrical as well as flat parts and its images are processed by a computer and presented in 16 shades of grey at magnifications ranging from 0.5 to 100X.

Ultrasonic pulses at frequencies around 3000kHz enable the instrument to probe 100mm beneath the surface of high-strength alloys and detect flaws a tenth of a millimetre wide. By using higher frequencies (up to 100MHz), the instrument can penetrate 5mm of material and show up flaws less than a hundredth of a millimetre wide, producing an image magnified up to a hundred times.

The higher the frequency of the ultrasound the greater the resolution of the microscope, but penetrating power falls off rapidly. The first ultrasonic microscopes, introduced 10 years ago, used ultrasonic pulses in the gigahertz range but could only "see" a few hundredths of a millimetre beneath the surface of samples. GE's lower frequency inspection system can be used on an industrial scale, for quality control during the manufacture of components ranging from solid state electronic devices to 100kg jet engine parts.



Above: a general view of the General Electric ultrasonic acoustic microscope. Shown at left is an image of a crystalline solder layer between two 30mm diameter silicon wafers.

Technical writing company for Collyn Rivers

Collyn Rivers, the founder and long-time managing editor of "Electronics Today International", has left the magazine. With his wife Jan Vernon (who was also with the publication) he has started a technical writing and publishing company, Vernon, Rivers & Associates.

Among other activities the company will prepare business computing and general technology features for "The Bulletin" and "Australian Business" magazines and the news sections of the newly redesigned monthly Australian Computer Society Bulletin.

Vernon, Rivers & Associates will also be undertaking specialised writing assignments for a number of trade and professional organisations in the computing and general technical areas. For further information contact the company at 18 Clifton Lane, East Balmain, NSW 2041. Phone (02) 818 3559.

New LCD pocket TV has a colour screen

Suwa Seikosha Company of Japan has released a miniature television set with a colour screen, just a few months after the appearance of the monochrome version of their "pocket television".

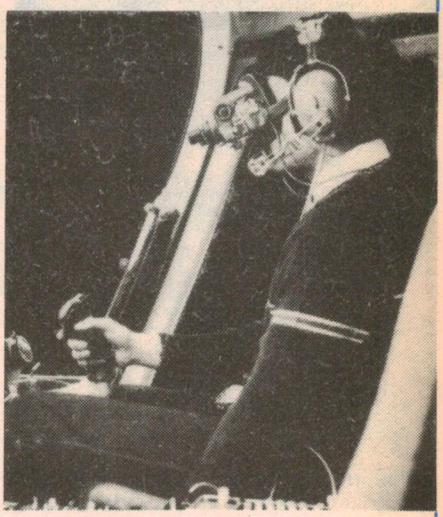
The 50mm (diagonal) display uses liquid crystal technology with separate red, green or blue filters for each pixel.

Night vision goggles from STC-Cannon

These night vision goggles (at right) from STC Cannon allow a user such as a helicopter pilot to see in the dark. Operated from a 2.7V battery, the goggles amplify starlight, moonlight or artificial light several thousand times to give the wearer a green-tinted view of terrain obscured by darkness. The bifocal lens can be adjusted for either long or short range viewing.

Overseas the goggles have been used in helicopter rescue missions at night, bushfire fighting and police, customs and military surveillance.

For further information contact STC Cannon, 280 Botany Rd, Alexandria, NSW. Phone (02) 699 0044.



Britain moves ahead with wave power research

Work has begun in Britain on a two-year engineering study which could lead to the construction of a £12 million "wave power" demonstration project. If the outcome of the study is favourable the National Engineering Laboratory of East Kilbride, Scotland would go ahead with the construction of a 4MW prototype of its "Breakwater" wave energy design.

NEL do not see their offshore power station as a means of providing base-load electricity to the national grid but as a source of power for remote communities whose existing supplies are based on diesel-fired generators.

The Breakwater would be a concrete structure fixed to the seabed in water up to 20 metres deep. It would operate by converting the movement of waves into a piston-like vertical movement of water in a closed chamber. Air trapped at the top of the chamber would be forced through a turbo-generator to produce electricity which would then be transmitted to shore by cable.

ZORBA

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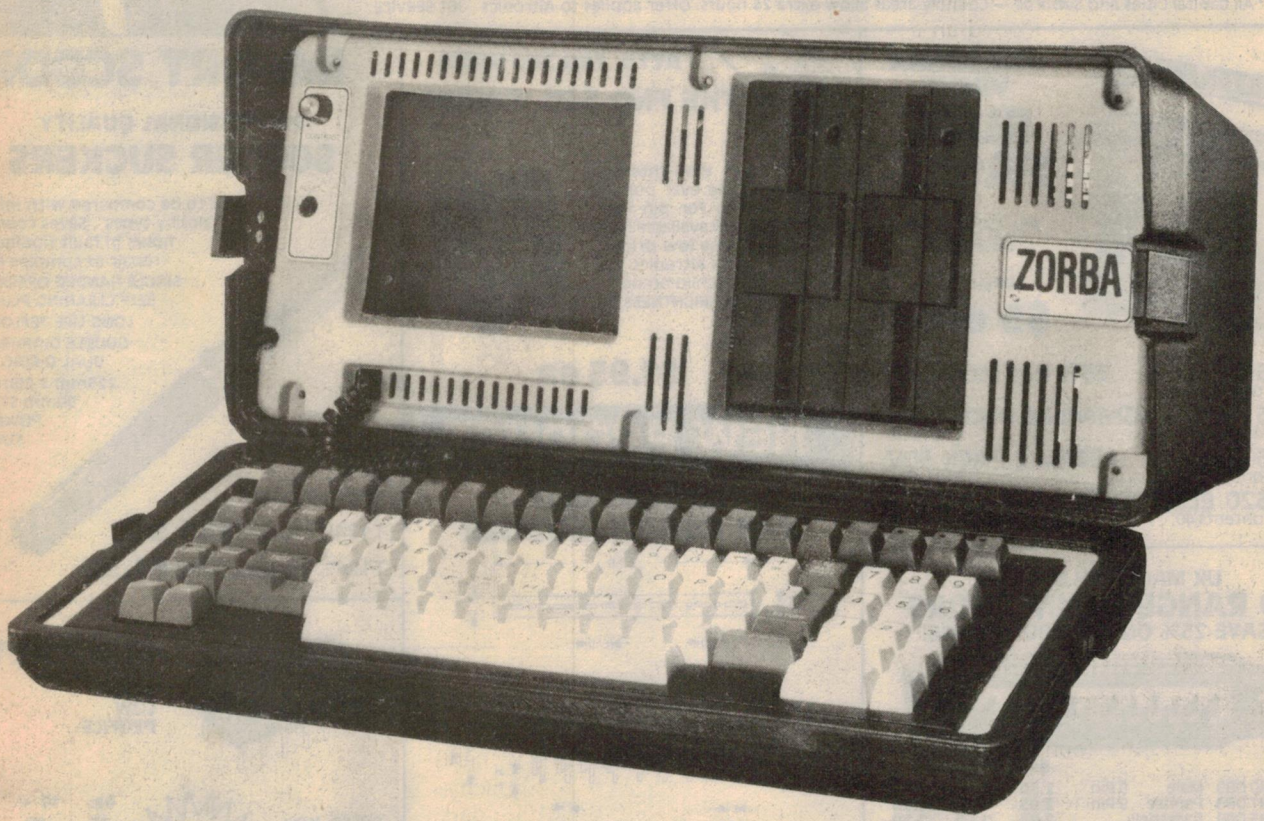

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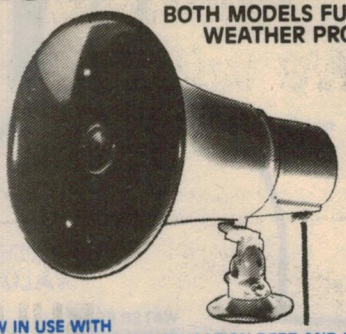

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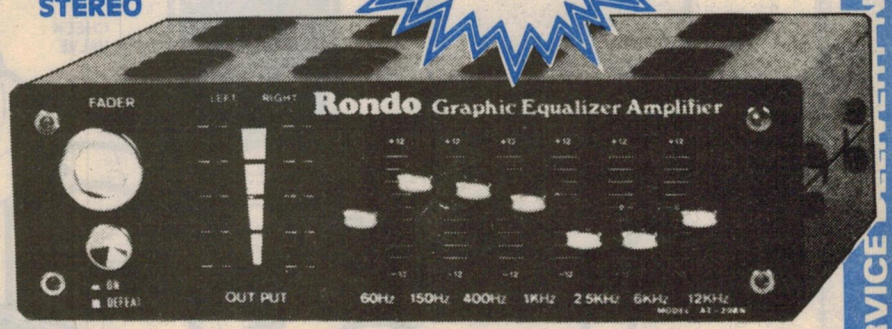

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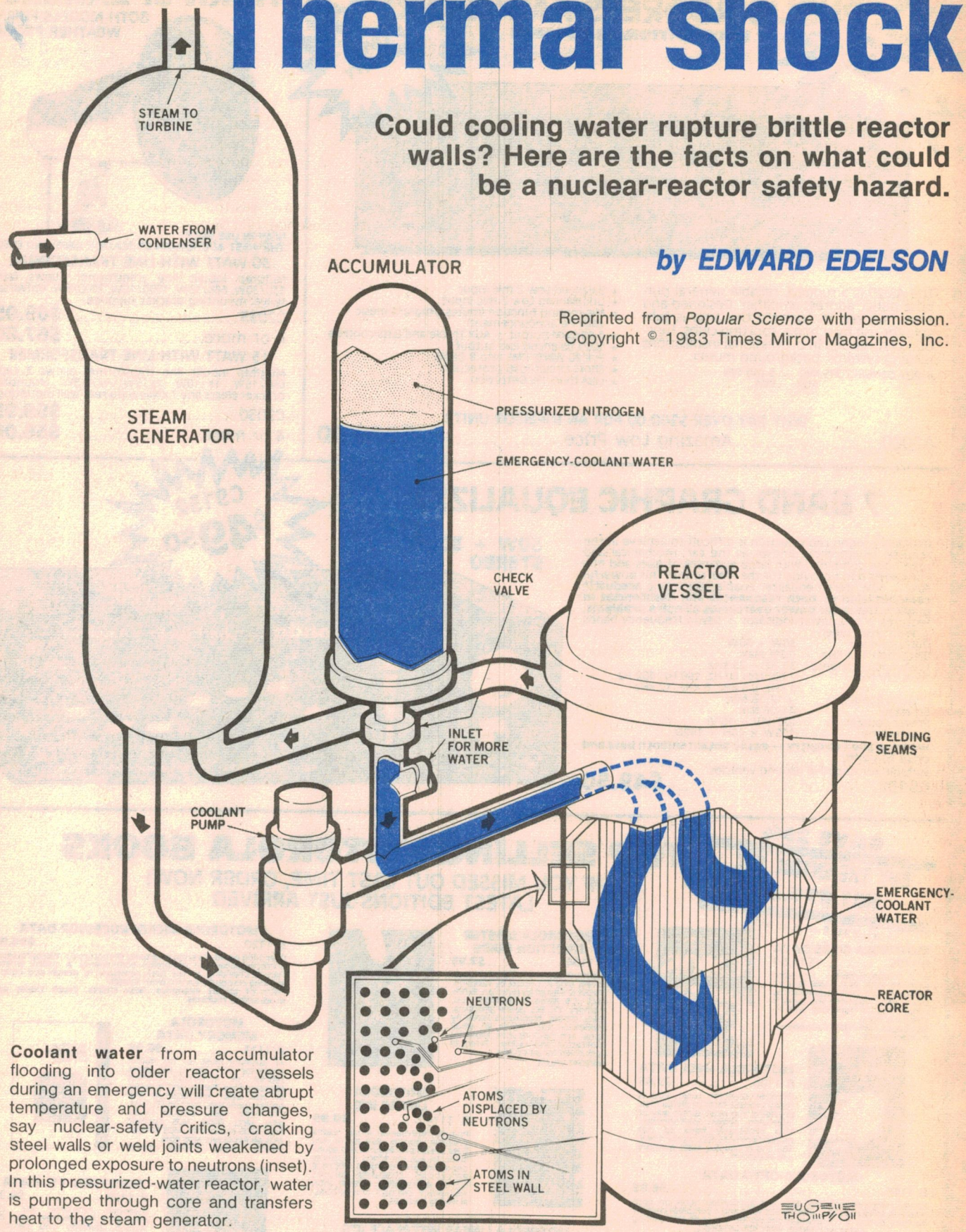
Thermal shock

Could cooling water rupture brittle reactor walls? Here are the facts on what could be a nuclear-reactor safety hazard.

by EDWARD EDELSON



Coolant water from accumulator flooding into older reactor vessels during an emergency will create abrupt temperature and pressure changes, say nuclear-safety critics, cracking steel walls or weld joints weakened by prolonged exposure to neutrons (inset). In this pressurized-water reactor, water is pumped through core and transfers heat to the steam generator.

— new nuclear-reactor safety hazard?

"There is a high, increasing likelihood that someday soon, during a seemingly minor malfunction at any of a dozen or more nuclear plants around the United States, the steel vessel that houses the radioactive core is going to crack like a piece of glass. The result will be a core meltdown, the most serious kind of accident, which will injure many people, destroy the plant, and probably destroy the nuclear industry with it." — Demetrios L. Basdekas, *The New York Times*, March 29, 1982.

Basdekas, a reactor-safety engineer with the Nuclear Regulatory Commission, continued his article to warn that radiation is making the metal-reactor vessels at some nuclear plants brittle. As a result, he wrote, water used to flood and cool reactor cores in an emergency could cause a meltdown instead of preventing one. The cause: abrupt changes in reactor pressure and temperature — a condition called pressurised thermal shock — would crack brittle vessels, allowing emergency water to escape.

The safety engineer's "piece-of-glass" charge quickly focused attention on thermal shock:

- The NRC commissioners held a public meeting.
- Rep Ed Markey of Massachusetts called a congressional hearing.
- Work on what was supposed to be a definitive study of the thermal-shock issue was accelerated by the NRC.

And the kind of debate that has become quite familiar in recent years has predictably erupted. Electrical utilities, reactor manufacturers, and the Nuclear Regulatory Commission say that the pressurised-thermal-shock problem is well in hand and that the "piece-of-glass" charge is absurd. Critics say that the nuclear people are talking through their hats because there simply isn't enough information available to assess the danger of pressurised thermal shock.

I've recently talked to experts on both sides of the question. At the moment there are no pat answers. But information about the hazard of thermal shock is accumulating steadily. Here is what you need to know.

Pressurised thermal shock has been widely publicised only recently. But inklings of a problem emerged in the 1960s.

At one power-plant reactor, a worker peered into a video monitor and manipulated a robotic arm down into the radioactive water of a 12-metre high reactor vessel. He slowly fished out a small basket hanging near the thick metal wall of the reactor. Inside the basket was a jumble of pencil-size steel bars, each alloyed with various metals and each bearing a V-shaped notch.

At a nearby test area, he carefully unloaded his irradiated catch behind shielded-glass windows. Deft manoeuvres with another robotic arm positioned each steel bar under a wedge-shaped hammer. Then, as samples were cooled or heated, he pushed a button, and the hammer slammed into the notches.

This routine Charpy test (named for its developer) yielded expected results: At lower temperatures, where metals become brittle, samples broke easily. Higher temperatures — like those in your kitchen oven — made the steel more ductile. Heated steel samples absorbed more hammer energy before snapping.

But something unexpected occurred when the worker slammed his test hammer onto bars alloyed with tiny amounts of copper. The steel — even warmed — broke easily. He raised the temperature. Still the brittle bars snapped. Finally at about 150°C, the bars became ductile instead of brittle. The presence of copper seemed to be producing strange results. Soon workers at other power and research reactors discovered the same unexpected embrittlement.

What puzzled everyone was the speedup of embrittlement because of the presence of copper, not the results of the standard Charpy tests on exposed metal samples. This technique — gradually changing metal temperatures and measuring how much hammer energy the metal can absorb without breaking — actually tests radiation damage. Radiation tends to make all metals brittle; irradiated metal must be raised to a higher temperature before it will become ductile. This shift in the transition temperature from brittle to ductile is a measure of radiation damage.

Nuclear researchers, aware of metal embrittlement, had earlier exposed samples to intense radiation. But the surge of reactor construction beginning in the 1960s found engineers without enough reliable data. To answer questions about long-term radiation effects on metal, baskets of Charpy samples had been positioned in early reactors.

> "Spools of copper-coated welding wire were used for welds. The copper was used to prevent rust. Somebody probably got a prize for the suggestion"

The principal cause of embrittlement was known to be neutrons, the atomic particles emitted by nuclear fission in the reactor core, colliding with metal in the reactor. "It's like billiards," says one expert. "Although metal atoms are much heavier than neutrons, when a high-energy neutron collides with a metal atom, the neutron forces the atom from its lattice — the geometric array of atoms."

The Charpy tests of the 1960s revealed that just a little copper in a steel alloy hastens embrittlement. Since that time, though, researchers have been uncertain why the presence of copper hastens radiation damage. Theodore U. Marston, who works on thermal shock at the Electric Power Research Institute in Palo Alto, California, says there's now strong evidence that neutron bombardment makes the copper clump together.

"Copper starts out in a solid as atoms fairly evenly distributed. Under radiation the atoms tend to come together as copper particles," he said. New instruments that let researchers see atoms within metals show this clumping effect, Marston says.

How much copper?

As the first discoveries of brittle irradiated steel containing copper became known, anxiety began to spread. How much copper was in the steel-alloy walls of reactor vessels across the country? Reactor-vessel manufacturers and utilities began leafing through old files to find what information they had about the copper content of metals in reactors.

Records showed that there was, some copper in the vessel walls themselves. "We used a lot of auto stock," explained Marston. "When you melt it, you can't get all the wiring out."

Continued on page 14

Thermal shock

But welds in vessel walls were the real problem. Before the industry realised what was happening, which was about 1972, spools of copper-coated welding wire were routinely used for these welds. "The copper was used to prevent rust," noted Stephen H. Hanauer, director of safety technology at the NRC. "Someone probably got a $10 prize for the suggestion."

Reactor builders switched to nickel-coated electrodes, but they couldn't replace the welds in older reactors. When I visited Marston last winter, the significance of those welds became clear. On his desk was a slab of metal that looked like a paperweight gone wild. I thought it was 20cm wide. But it was really 20cm thick – the thickness of a reactor-vessel wall.

The weld was a yellow stripe in the steel, tapering from 7.5cm thick on one side to 5cm on the other. Marston told me that it can take three weeks of repeated passes with electrodes to complete one of those welds. That type of weld, engineered to be a powerful bond between huge steel sections of reactor vessels, contained enough copper to become a potential hazard instead.

Interest in reactor-vessel embrittlement heated up in 1977, Marston recalls. There was trouble with the sample holders in a reactor built by Babcock and Wilcox, one of the major suppliers, he says. Vibration kept knocking them loose. All the samples were taken out, and "it looked worse than we thought," Marston said, indicating that embrittlement was progressing faster than expected in the test samples.

Added to this continued confirmation of embrittled-metal samples and copper contamination of vessels was an event the following year that, for some, increased the alarm.

The Rancho Seco transient

On March 20, 1978, a worker at the Rancho Seco nuclear generating plant near Sacramento, California, dropped a light bulb into an instrument panel. The panel shorted out and the plant's instruments went haywire, flashing fake signals to the control systems. Rancho Seco's emergency cooling system kicked into operation. Cold water flooded into the reactor, dropping the temperature from 305°C to 140°C in a little more than an hour.

Pressure inside the reactor vessel first dropped from the normal 15,160 kPa (2200 psi) to under 11,000 kPa (1600 psi). Then, as high-pressure water pumps were triggered, the pressure went back over 14,000 kPa (2000 psi). With no reliable instrumentation to guide them, control-room technicians kept the cold water flowing, maintaining the combination of unexpectedly low temperature and high pressure for several hours.

The Rancho Seco "transient," as nuclear engineers call it, made it clear that pressurised-water reactors were susceptible to abrupt changes in temperature and pressure. Could any pressurised reactors already have small cracks? And could vessel walls containing such cracks, subjected to sudden changes of temperature and pressure during an accident, then rupture, draining the coolant water and producing a catastrophic melt-down of the core?

The truth is that nobody knows for certain. Calculations indicate that under pressurised-thermal-shock conditions, a reactor vessel will fail only if cracks of a certain dimension are present on the inside wall. Inspections throughout the industry have used ultrasound and other nondestructive testing methods and thus far have found no such cracks.

Industry representatives say they are reasonably confident that no cracks are there. Critics say the inspection equipment isn't good enough to detect the cracks. The NRC says its analyses assume that some cracks exist, no matter what inspections show.

Richard Cheverton of the Oak Ridge National Laboratory, whose team has performed many of the thermal-shock analyses, says assumptions about weaknesses in nuclear power plants had to be made. Take the critical issue of cracks in the reactor-vessel walls. "It's difficult to look for flaws after the reactor is in operation, and it's still a question of how good a job one can do," Cheverton said. "It's not clear yet whether some of the shallow flaws that can get us into trouble can be found with accuracy, so we tend to assume that the flaws will be there."

But Richard J. Sero, who heads a program on thermal shock for Westinghouse (a major plant builder), maintains that there is growing evidence to support the belief that the cracks aren't there. Engineers often inspect working-reactor vessels with ultrasound equipment, whose echoes are analysed to detect anything unusual in the vessel wall – a crack, an inclusion of different material in the metal, an unevenness in the surface.

Ultrasound inspection is complicated somewhat by the fact that reactor vessels have a 9.5mm-thick cladding – a permanently bonded layer – of stainless steel on the inside surface that can produce false echo patterns. But that's not an insuperable problem. Sero says he's impressed by the sensitivity of the equipment.

> "The real problem is that the nation's nuclear regulators and the manufacturers allowed a major construction program to roar ahead without considering the dangers"

"We've done about a half-dozen full-vessel inspections," Sero said. "You do pick up what we call 'indications' – as many as 20 in some vessels. When you pick up any anomalies at all, you must look at your pre-service inspection to see if they existed before and what size they were.

"We've found that the equipment can pick up things like layers in the cladding," Sero continued. "When we've gone to the inspection reports, we've found that there are layers in the cladding at the same depth of the indication. Our conclusion is that in all the inspections we've done, we haven't found any indications that we can't resolve as inclusions of different material or layers."

Sero says Westinghouse gained confidence in the inspection results when one test showed a gouge on the outside wall of a reactor vessel. "We were able to get pictures of the reactor vessel that were taken before it was installed," he said. "We found that it was a gouge that existed before it went to the plant." A sample of a vessel wall containing a crack is used to calibrate instruments.

Risk assessment

The NRC recently released a detailed study on pressurised thermal shock and reactor safety. If you really want a good fight, ask people about the reliability of those safety estimates. The method the NRC and the industry uses is called probabilistic risk assessment. It's designed to get around a rather impressive lack of concrete evidence. All the calculations about pressurised thermal shock, for example, are based on just eight events that have occurred at nuclear plants, including the Rancho Seco transient and the most famous incident of all, Three Mile Island.

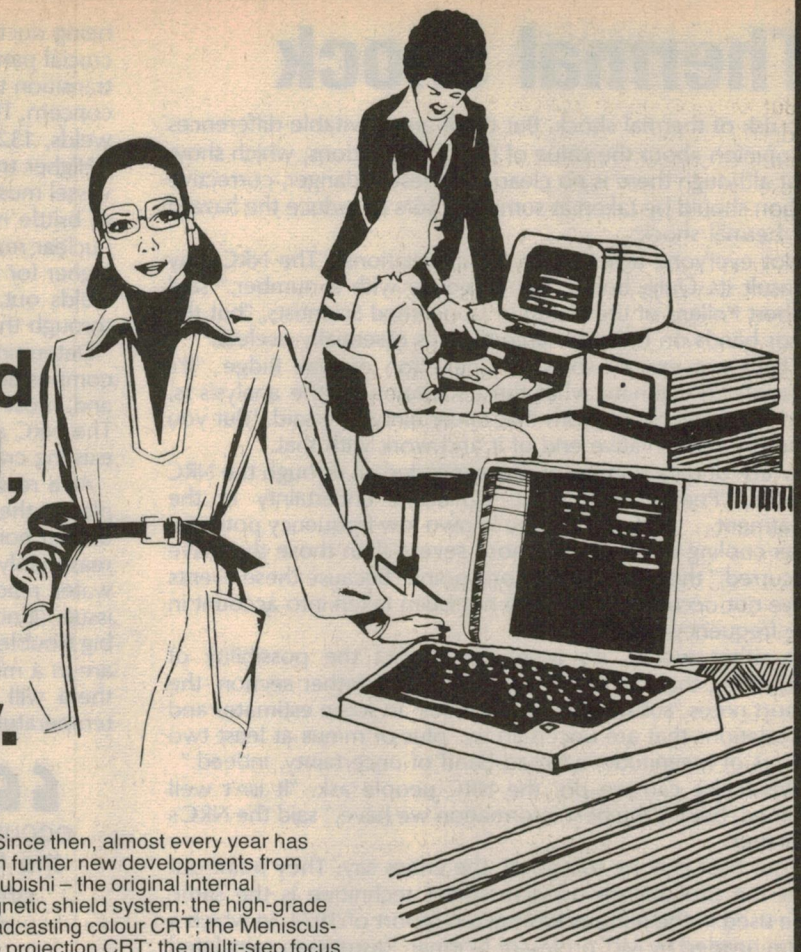
In a probabilistic risk assessment, you estimate the likelihood of an event that initiates a transient, then estimate the likelihood of the reaction to that event, the reaction to that reaction, and so on down the line.

Westinghouse, for example, has a computer analysis that starts with 17 possible initiators and runs through event trees to more than 8,200 end points. The NRC has done the same thing. Its numbers come out more or less in agreement about

Continued on page 16

MITSUBISHI ELECTRIC

If Felicity had a better VDU, you'd get better work from Felicity.



In this day and age, productivity and technology go hand in hand – the more advanced the tool, the higher the productivity.

So it is with monitors.

Today there seems to be a belief that because computers are high technology, there's little real difference between the peripherals. So buyers tend to buy on price alone.

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Since then, almost every year has seen further new developments from Mitsubishi – the original internal magnetic shield system; the high-grade broadcasting colour CRT; the Meniscus-type projection CRT; the multi-step focus electron gun; the original arc-shield gun; the first anti-reflective coating – the list goes on. Yet despite this massive R & D investment, the price of a top quality Mitsubishi monitor is only a little bit more – and it could save you so much in the long term.

Mitsubishi monitors, both colour and mono, cased and uncased, are distributed in Australia by Nexus Electronics of Sydney; and Sycom of Melbourne, two companies dedicated to the pursuit of excellence. Their marketing and service support is second to none, anywhere in the world; which is precisely why they were chosen by Mitsubishi Electric, itself a company devoted to excellence in electronics.

In addition to monitors, Nexus and Sycom also distribute Mitsubishi semiconductors, and their 5¼" and 8" disk drives – both products of superior Mitsubishi technology.

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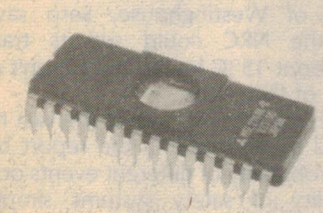
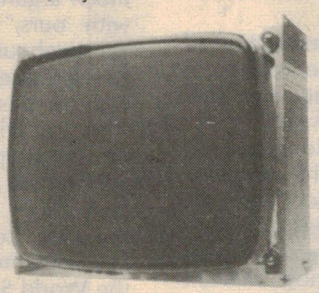
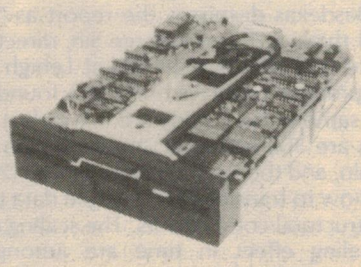


Mitsubishi semiconductors



Mitsubishi display monitors



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Thermal shock

the risk of thermal shock. But there are inevitable differences of opinion about the value of those calculations, which show that although there is no clear and present danger, corrective action should be taken at some reactors to reduce the hazard of thermal shock.

Not everyone agrees with the calculations. "The NRC may consult its Quija board and come up with a number," said Robert Pollard of the Union of Concerned Scientists, "but the error bands on it are so large that it's essentially useless."

That's not exactly so, says Cheverton of Oak Ridge. "It's possible to estimate what the uncertainty in the analysis is, and you have to live with that uncertainty," he said. "But you take the conservative end of it and work with that."

A lack of data is more or less conceded all through the NRC report. "Perhaps the most significant uncertainty in the treatment . . . is that there are known low-frequency potential over-cooling events much more severe than those that have occurred," the report says at one point. "Because these events have not occurred, they have not been taken into account in the frequency distribution."

In other words, it's tough to predict the possibility of something that has never happened. In another section, the report notes "substantial uncertainties" in some estimates and calculations that are uncertain by "plus or minus at least two orders of magnitude, a broad band of uncertainty, indeed."

What else can we do? the NRC people ask. "It isn't well defined, but it's the best information we have," said the NRC's Hanauer.

Your best is none too good, the critics say. They point out that the probabilistic-risk-assessment technique is the same one used in the famous Rasmussen report of 1974, in which a team headed by MIT professor Norman Rasmussen calculated the risks of nuclear accidents. Rasmussen came up with some comfortingly low-risk figures. Just last year, though, the NRC looked over the operating data that have accumulated since then and concluded that the odds of a nuclear accident occurring calculated by Rasmussen were low by a factor of 30.

Hanauer says that risk calculators have learned a lot from Rasmussen's pioneering effort. "He kissed off earthquakes in two pages and floods in two lines," Hanauer noted. Taking one volume of a shelf-long safety assessment of the Indian Point reactor near New York City, Hanauer pointed out that earthquake and floods were toward the top of the list of risks. The NRC has learned to include such risks in its risk assessment, Hanauer says.

But Basdekas dismisses the report as "the quantification of wishful thinking." And George Sih, director of the Institute of Fracture and Solid Mechanics at Lehigh University, says that the impressive report is built on a foundation of sand.

"The samples they study are five inches (13cm) long, and the vessels are 500 inches (1.3m) long," Sih said. "The sample is very thin, and the vessel is eight inches (20cm) thick. We don't know how to transfer small-sample data to the design of large-scale structural components. The scaling effect in size and also the scaling effect in time are among the most difficult questions we have."

If critics think the NRC has been too speculative, industry believes the report is too conservative. You can arrive at just about any conclusion you want by putting in the appropriate numbers, Marston says. "By changing the assumptions," he explained, "I can show that one of these things has no useful life at all or a lifetime of 30 to 40 years." The NRC consistently takes the most conservative numbers for its estimates, he says.

The transition temperature

One of the key factors that the NRC's experts looked at was the transition temperature at which a piece of metal stops being ductile and becomes brittle enough to break easily. A crucial part of the NRC report was to set a point at which this transition temperature in a given reactor would be cause for concern. The report sets the danger point at 150°C for vertical welds, 132°C for horizontal ones.

Higher transition temperatures are worse, since the reactor vessel must be maintained at these temperatures if the effects of brittle metal are to be avoided. The original standard for nuclear reactors was no more than 93°C. The temperature is higher for vertical welds because pressure tends to force the welds out, increasing the possibility that a crack will break through the vessel wall.

Determining a transition temperature depends on the composition of a metal, the amount of radiation it receives, and, most controversially, the stresses to which it is exposed. The NRC staff used a formula to predict how assumed pre-existing cracks might extend into the vessel wall.

As a result of tests on the rate of embrittlement at various plants, the NRC predicted when some of them will reach a danger point. All things considered, the NRC report reached a reasonably comforting conclusion. It listed 40 pressurised-water reactors in which pressurised thermal shock was an issue. "If no one does anything, we've got one reactor that's in big trouble, four others that are a little behind it, and four that are in a mild kind of trouble," Hanauer told me. "The rest of them will not reach the screening criterion (the transition temperature) during the anticipated life of the plant."

> "Because certain events have not occurred, they have not been taken into the frequency distribution. It's tough to predict the possibility of something that has never happened"

The "big-trouble" generating plant is the H. B. Robinson 2 reactor of Carolina Power and Light. Hanauer calculated that if nothing were done, it would reach the transition-temperature criterion in September of 1987. Turkey Point 3 and 4 in Florida get there in 1988; Calvert Cliffs 1 in Maryland gets there in 1989; and Fort Calhoun in Nebraska arrives in 1990. Rancho Seco, Maine Yankee, Oconee 2 in South Carolina, and Three Mile Island 1 arrive in the 1990s. Everything else is 21st century, Hanauer says.

Reactor manufacturers accepted those numbers without too much argument. "Their conclusions are more or less in line with ours," said Sero of Westinghouse. Sero says that Westinghouse thinks the NRC could set its transition-temperature numbers about 15°C lower, but he isn't arguing with the basic premises of the report.

Nuclear critics are. They centre their fire on the vast number of assumptions that had to be made in the report because information about the probability of different events occurring and about the reliability of safety systems simply isn't available. Rep Markey's reaction, for example, was that the risk-assessment technique was "like predicting the winner of the World Series after the first exhibition game."

Reducing the risk

There's also a lot that the utilities and manufacturers can do to lessen any possible danger, industry experts say. One easy step is to reshuffle the fuel elements in the reactor core, putting older fuel elements, which emit fewer neutrons, close to the vessel wall. "It's easy and cheap to reduce neutron flux by a factor of two," acknowledged Hanauer.

Critics say that repositioning the fuel elements isn't enough. They want American utilities to reduce neutron exposure even further by inserting dummy fuel elements next to the

Continued on page 17

Thermal shock

vessel wall. That's been done at two reactors in West Germany and one Russian-built reactor in Finland. But utilities are reluctant to take the reduction in generating capacity that dummy fuel elements bring.

There are many other steps that can be taken, Marston said. One is the marvellously simple measure of heating the emergency cooling water to reduce thermal shock. Keeping the emergency water supply at 50°C rather than room temperature is cheap and effective, Marston says.

Improved training for reactor operators is another industry option. The idea is to get them ready for all the problems that could lead to a significant transient, then avoid the sequences that end in serious trouble.

The last resort is annealing. The reactor would be shut down, all the fuel elements would be removed, and the vessel would be heated to 450°C for a week. A study done by Westinghouse for the Electric Power Research Institute concluded that annealing would make the vessel walls young again. The process isn't cheap. One report cited cost of $60 million or more for a single reactor.

No one is thinking about annealing right now. Instead, utilities and manufacturers are making detailed studies of all the factors affecting the thermal-shock issue for individual plants. The NRC report has asked for such a plant-specific report at least three years before a reactor reaches its screening criterion for danger.

For the Robinson 2 reactor, the report would be due in 1984. Carolina Power and Light is hard at work, says Thomas S. Elleman, who is in charge of nuclear safety. The vessel wall has been inspected, and no cracks were found. New training for reactor personnel is under way. The company is studying a proposal to heat the emergency water supply.

Neutron exposure has been reduced by putting the older fuel elements next to the reactor wall. How much extra time will the program buy? "It's premature to speculate about that," Elleman said.

There's no panic at the NRC, the manufacturers, or the utilities. The problem is well understood, Cheverton says, and the Oak Ridge analysis indicated that even if worse came to worst, a reactor vessel would not break wide open. "Even though the inner portion is brittle, the outer portion still is relatively tough because the radiation damage is attenuated through the wall," Cheverton said. "A crack might be driven through the inner part, but it tends to arrest at the outer part."

But that assessment could easily be wrong, says Pollard of the Union of Concerned Scientists. "There's no dispute that current emergency systems would not be able to cope with a fracture of the reactor vessel," he said. "For other problems, you can make a reasonable argument that you have some defence in depth. The defence-in-depth philosophy disappears when you talk about pressurised thermal shock."

The real problem, Pollard says, is that the nation's nuclear regulators and the manufacturers allowed a major construction program to roar ahead without considering the range of unknown dangers that lay before them.

"The Atomic Energy Commission went forward with all this undue optimism," complained Pollard, who resigned from his job as a regulator years ago in disgust. "Now we're in a position where nothing can be done to correct the mistakes without causing someone undue harm. I expected them to do the job back in the 1960s. Now everyone but the nuclear industry has to suffer."

"My perception is that the problem is well in hand," said Westinghouse's Sero. "We have significant research programs under way, we are putting significant money and engineering efforts into it, and we have a firm understanding that is going to improve, which will show that our predictions were very conservative."

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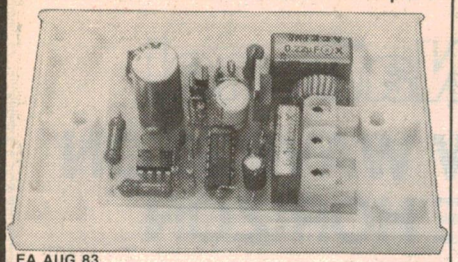

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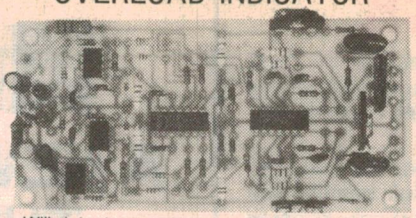

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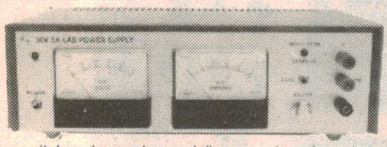

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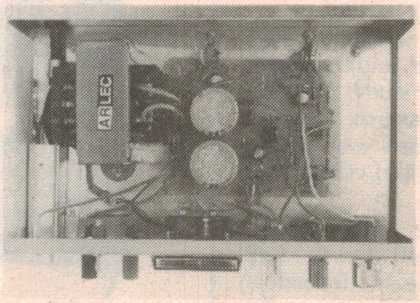

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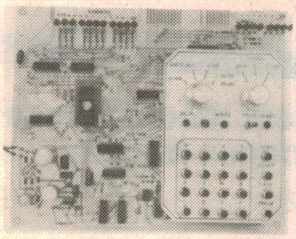

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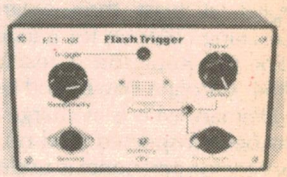

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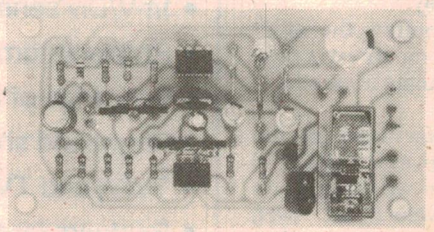

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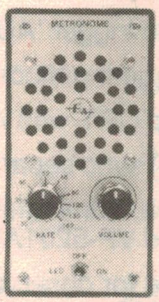

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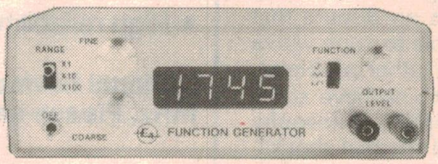

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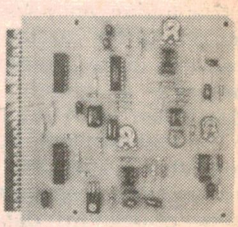

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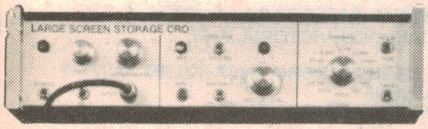

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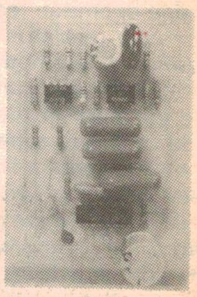

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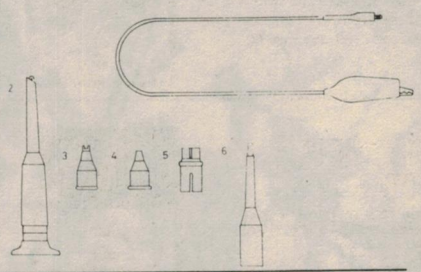

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A Flight on the NASA

In June this year the NASA Airborne Observatory visited Australia for seven weeks to explore the southern skies. Editor Leo Simpson was invited to be present on one of the missions.

Five o'clock on a wintry June afternoon at Richmond RAAF base; A Lockheed C-141 transport sits at the end of the runway awaiting clearance for takeoff. Not a big plane by today's standards, it nevertheless looks massive with its low slung undercarriage and drooping wings. With the OK from the control tower, NASA Flight 714 lumbers down the runway with all four engines flat chat and finally lifts off at 135 knots. Takeoff weight tonight is 286,000lb (130 tonnes) of which 125,000lb (almost 57 tonnes) is fuel.

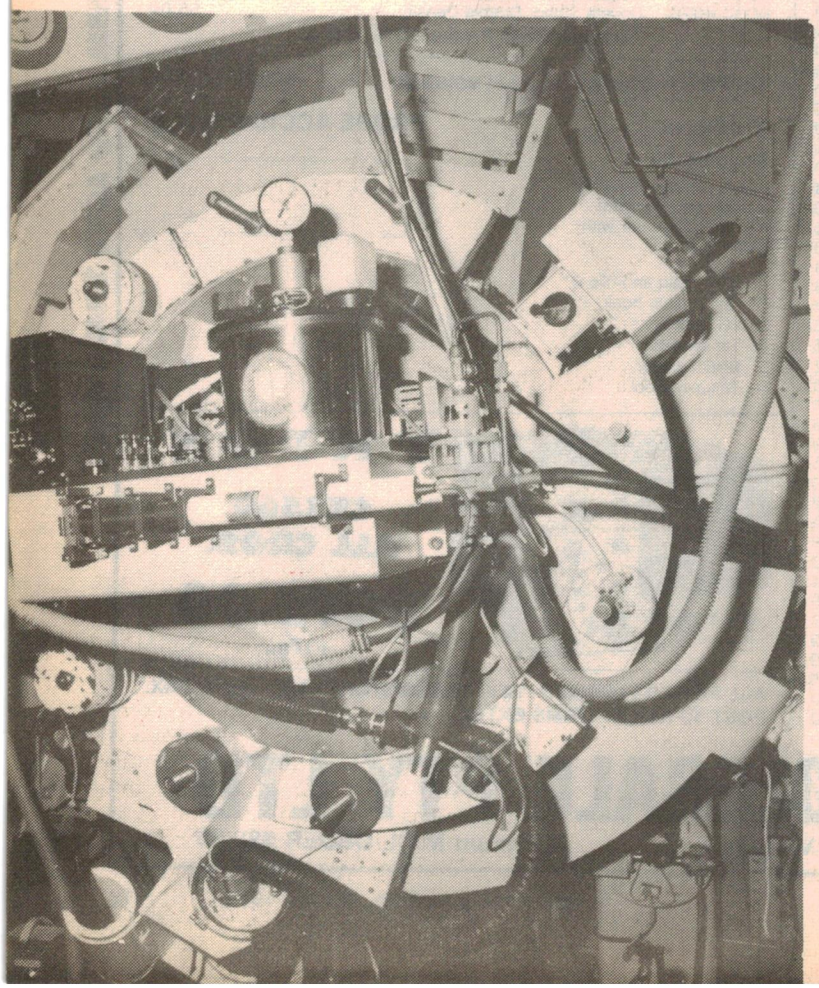
NASA 714 is a most unusual airplane although to the casual observer it is unremarkable. It has only one purpose: to look at the night-time sky from an extreme altitude. For this is a flying observatory and the only payload on board is a 91cm reflecting telescope and all its ancillary equipment. In fact, for most of this ensuing 7½-hour journey, the telescope will actually fly the plane!

As we break through the cloud layer at around 4000ft, the pilot comments "Power's good" and settles back for the long climb to our initial height of 38,000 feet (just over 11½km). After several hours we will finally level out at 42,000 feet (almost 13km). This is far above the normal ceiling of commercial airliners; so much so that all the crew and this writer have been individually fitted out with full oxygen masks, just in case . . .

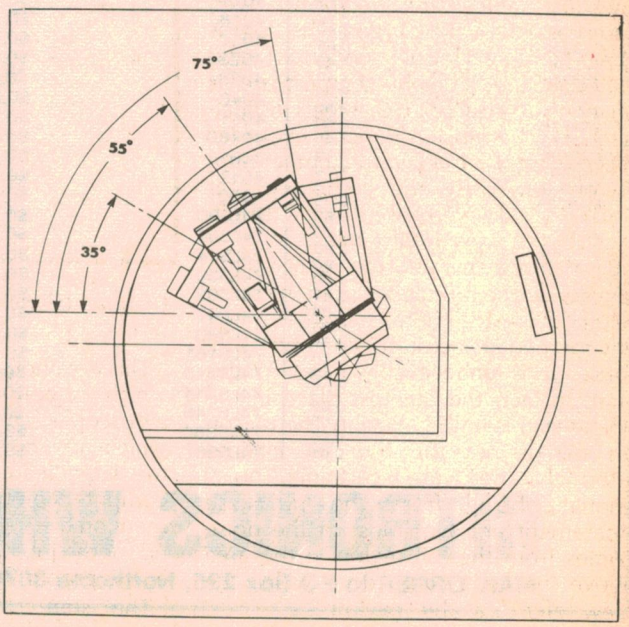
The reason for going so high is simple. We will be above 85% of the Earth's atmosphere and clear of 99% of the water vapour. The water vapour in the Earth's atmosphere reflects or absorbs more than 90% of the infrared radiation from celestial objects and it is the infrared region that this observatory explores.

A jet plane might seem to be the last place you would seriously consider for installation of a telescope. But the plane has a particularly sensitive autopilot, a very large air-bearing to decouple the telescope from aircraft vibrations, three gas-bearing gyroscopes, one for each axis of telescope motion and a video star tracker. Pointing stability of the telescope during a mission is three seconds of arc (about 0.001°). This compares with the one second of arc accuracy of the 3.9 metre reflecting telescope at Siding Spring near Coonabarabran, NSW.

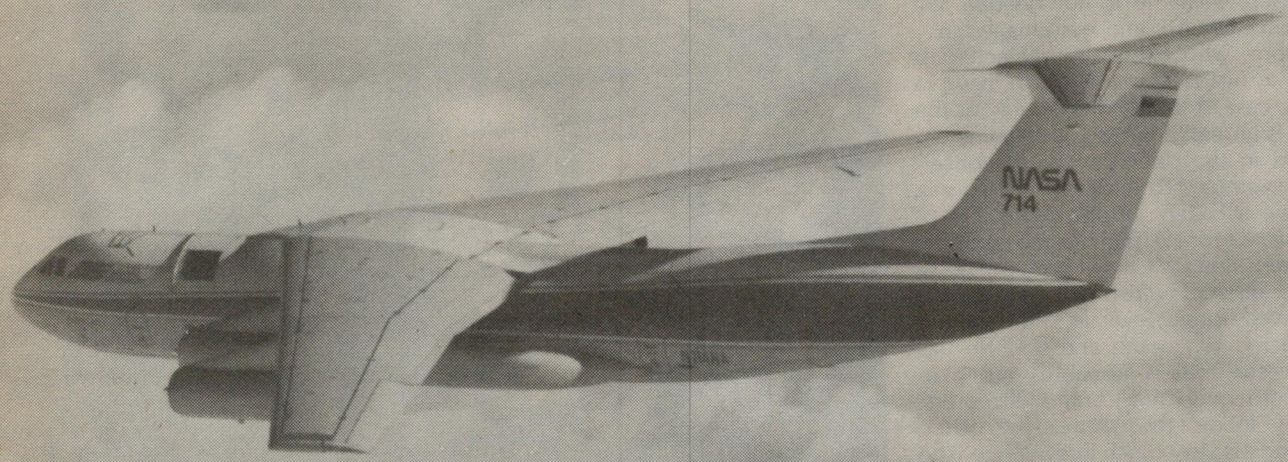
Sitting in an open cavity just ahead of the port side wing, the telescope points at right angles to the aircraft's direction of motion. There is no window glass to attenuate or reflect infrared so the open cavity does add some drag and turbulence to the aircraft's motion. This turbulence and any tendency towards resonance in the open cavity are mitigated by a spoiler fence just ahead of the open port. Before the port is opened it is purged with dry nitrogen to avoid ic-



At left is the focus flange of the telescope showing the liquid helium cooled Dewar flask



Airborne Observatory

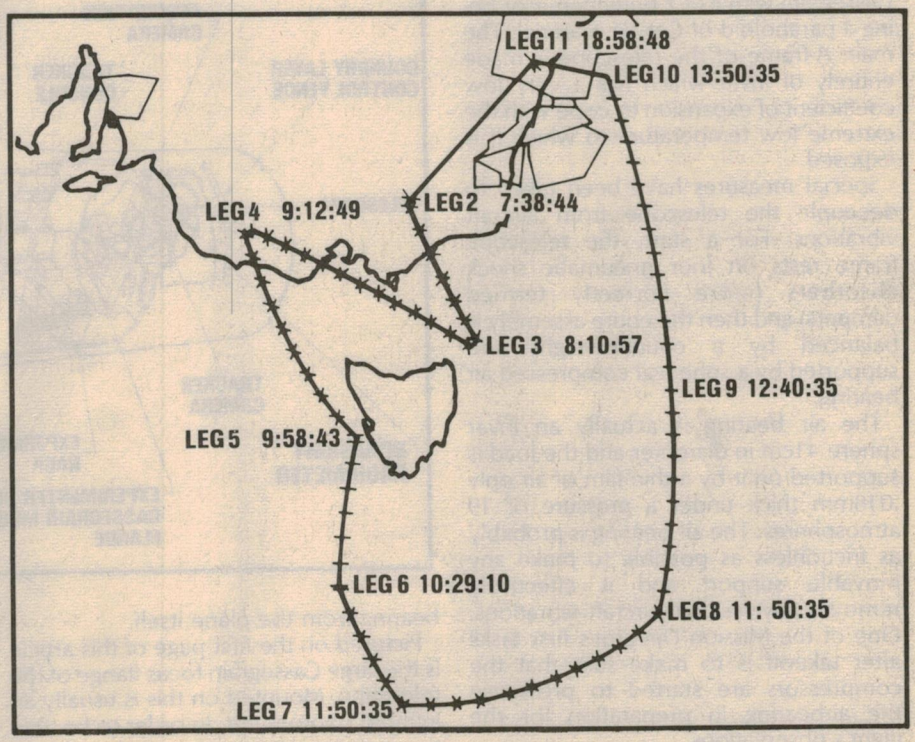


ing of the telescope which would otherwise inevitably occur on initial exposure to the sub-zero stratosphere.

Inside the C-141 it is a far cry from the streamlined interior of a commercial airliner. The only similarity is that some of the seats have clearly been appropriated from a passenger plane and as such, their bright orange upholstery makes a stark contrast with the otherwise strictly utilitarian surroundings. Everything looks "technical" and the dull grey/green paint beloved of industrial designers in the 50s and 60s is much in evidence. Even the drink dispenser looks technical and forbidding!

Overhead, a myriad array of pipes, lines and cables carry electrical power, compressed air and oxygen. The floor is bare metal and cold underfoot and although the ambient temperature is hovering at around 20°C, it feels distinctly chilly. The mission director explained that they prefer to keep the temperature lowish, otherwise the computer gear starts to get overheated! As a result, most of the crew wear parkas.

Besides the chill and the slight buffetting due to the turbulence from the open telescope cavity, there is another major environmental factor to contend with. Noise. It is unbelievably noisy in this craft. In fact, the quietest place in the whole ship is in the cockpit. The reason for this is not the four jet engines although they are certainly noisy enough, being from the pre-Noise Abatement era. No, most of the noise comes from the tail region in the area above the large cargo door which the crew refer to as the "hayloft".



Each leg of the flight plan was used to observe a particular celestial object.

This area houses the axial compressors which supply the air bearing and gyroscopes and the rotary converters which provide 110VAC at 60Hz to run the large load of instrumentation and computers on board. Most of the equipment on board is not especially ruggedised for the job but it is all well tied down, in the proper interests of safety.

The sum total of all the above-mentioned machinery adds up to bedlam. There is just no chance of making yourself understood to a person right next to you unless you use a communications headset which everyone is fitted with. If you go for a walk in the plane, you wear your headset all the time, trailing your umbilical cord and plug, to be inserted in the nearest available socket when you want to com-

NASA Airborne Observatory

municate. I note that a crewman who goes off to the back of the plane for a short kip while he is not needed still wears his headset and it is plugged in!

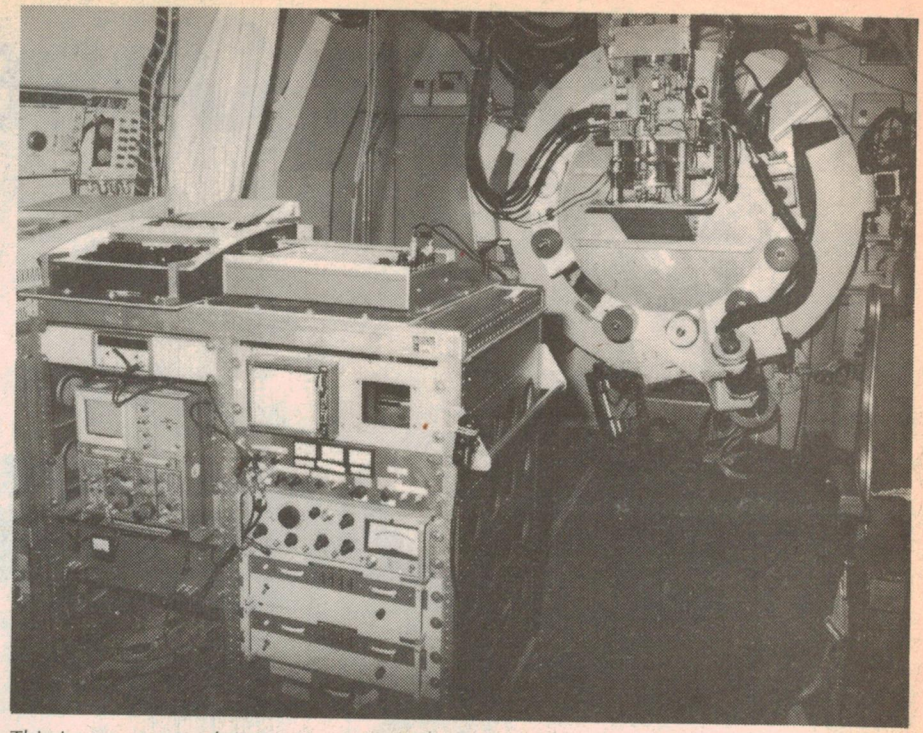
Anyone who habitually neglected to wear a headset would soon have a severe case of "boiler-maker's ear" as the noise is unremitting. As you become absorbed in the operation of the observatory you tend to forget the noise, only to have it rudely intrude again if your headset becomes slightly dislodged or strangely, if you swallow! Even the occasional discreet yawn brings up the perceived sound level as the sound is conducted via mouth and skull! In this respect the noise is probably worse than those other very noisy craft, helicopters.

From inside the plane, the 91cm telescope is very much in evidence. The pressure bulkhead seems to occupy most of the cross-section of the craft (as shown in the diagram on the first page of this article). The telescope itself is a bent Cassegrain with its f/2 primary mirror being a paraboloid of Cer-Vit material. The main A-frame of the telescope is made entirely of Invar which has a very low coefficient of expansion to cope with the extreme low temperature to which it is exposed.

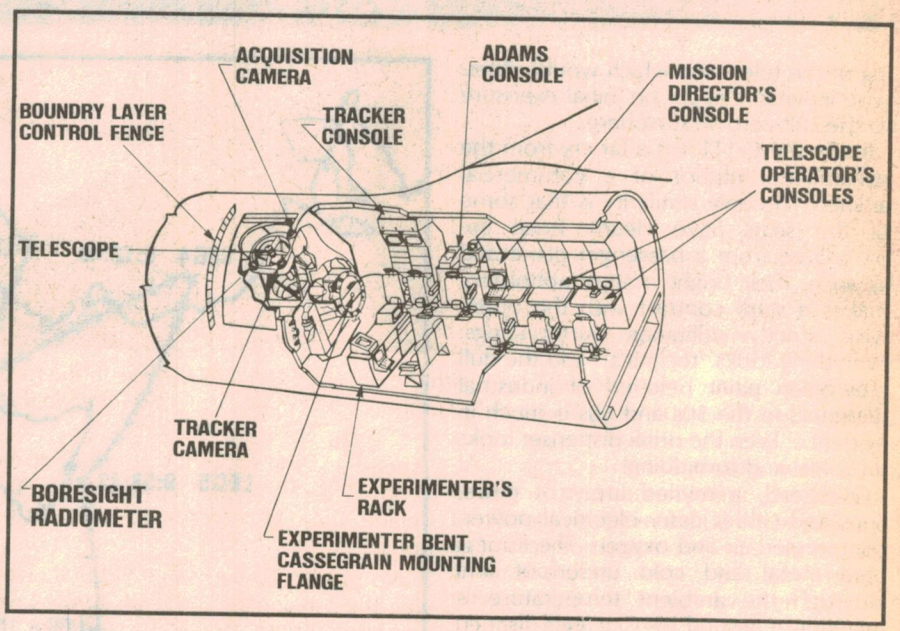
Special measures have been taken to decouple the telescope from aircraft vibrations. For a start, the telescope frame rests on four pneumatic shock absorbers (more correctly termed dampers) and then the entire assembly is balanced by a counterweight and supported by a spherical compressed air bearing.

The air bearing is actually an Invar sphere 41cm in diameter and the load is supported on it by a thin film of air only .018mm thick under a pressure of 19 atmospheres. The air bearing is probably as frictionless as possible to make any movable support and it effectively removes any residual aircraft vibrations. One of the Mission Director's first tasks after takeoff is to make sure that the compressors are started to pressurise the airbearing in preparation for the night's observations.

The temperatures of the major telescope components are monitored continuously during the flight and they are available at the press of a button on a number of computer displays at various stations in the plane. Interestingly, although the outside temperature was registering at below minus 50°C, the telescope mirror itself stabilised at just a few degrees below zero, probably because of the heat conduction from the surrounding structure and via the airbearing from the plane itself.



This instrument rack is connected to the measuring photometers or spectrometers.

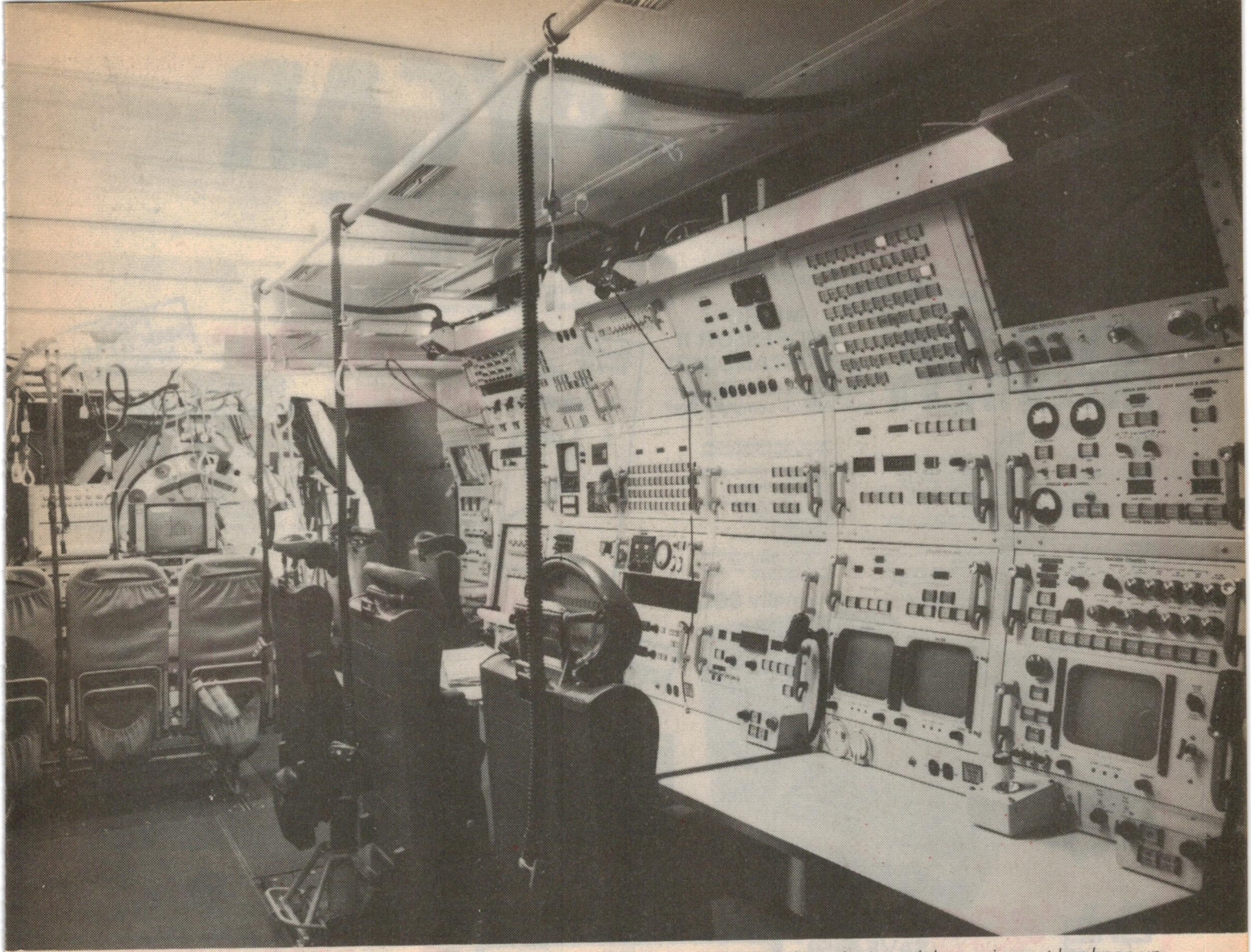


Pictured on the first page of this article is the large Cassegrain focus flange of the telescope. Mounted on this is usually an infrared photometer. In order to be able to measure extremely weak infrared emanations the photometer is housed in a large Dewar flask holding liquid Helium, to hold the temperature at 4° Kelvin or just 4° above absolute zero.

A standard technique in infrared astronomy is to have an oscillating secondary mirror. In this way, the photometer detector is pointed first at the selected infrared source and then at a neighbouring area of blank sky and so on in rapid succession. This makes it possible to cancel out most of the background infrared emanation from the sky and thus obtain a more accurate result.

And while the main pursuit of the airborne observatory is in the infrared region, the telescope can and has been used over its total observable band from the near ultraviolet (300 nanometers) down to the millimetre wavelengths. In fact, on its last Australian sojourn in 1977, the observatory discovered that the planet Uranus has rings. Saturn is not unique any longer.

Perhaps the most interesting aspect of the airborne observatory is the means for tracking stars. As can be imagined it is far harder to find a given celestial object



This is a general view inside the C-141 with the Mission Directors console in the foreground. Most of the equipment has been updated since this photo was taken, with computer terminals displacing individual instruments.

in a plane than it is on the ground. Attached to the telescope is a video camera with zoom lens (to give a 12-to-3 degree field of vision) and special image intensifiers. The monitor picture resulting is matched with an ADAMS computer generated map of the star field desired. ADAMS (Airborne Data Acquisition and Management System) has stored in memory the co-ordinates and magnitudes of the entire Smithsonian Star Catalog – hundreds of thousands of stars!

The video acquisition system is regularly used to track stars down to magnitude 12 and has been used to magnitude 16. (Stars of magnitude between one and six are visible to the naked eye and a magnitude range of five encompasses a light ratio of 100:1.) Once the desired star has been locked onto, the telescope flies the plane, constantly changing the heading slightly to compensate for the Earth's rotation. This raises a difficulty. The course plotted cannot take into account changes from predicted wind speed and directions. As a result, at the end of a given leg of the course, the plane may be far from its predicted position.

No matter. Towards the end of a given leg the Mission Director hits a few keys on his computer terminal and is instantly issued with a revised flight plan for the remainder of the journey with each leg adjusted to bring us back home at the appointed time. Times shown on the flight plan in this article are in Universal Co-ordinated Time, by the way.

Our flight that night effectively started from central Victoria, zipped out over the Tasman Sea and then back over Flinders Island to Victoria. From there it skirted down the west coast of Tasmania and actually went far south of there, as far as the 49th parallel. Then it was a two-hour stretch all the way up to a point due east of Richmond.

While the flight itself was smooth it was certainly not uneventful. At one point a Dewar flask had to be changed over because of a troublesome photometer and at another point the entire computer system crashed due to some gremlin and we had to wait a minute or so while one of the operators re-booted the relevant disk. Hmm. And towards the end of the trip the video acquisition camera lost hold due to the telescope window moving across its field of view. While the crew were frantically trying to lock it back on, the Mission Director told them to wrap it up as there was no time left.

From there, we virtually fell out of the sky from 42,000 feet to the smooth as silk touchdown at Richmond. In the seven-and-a-half hours we had covered some 4800 kilometres and seen a hell of a lot of sky. To be a guest astronomer on one of those missions would be like a dream come true. For me, it was a once-in-a-lifetime journey. Thanks to NASA.

(All illustrations are supplied by courtesy of National Aeronautics and Space Administration, USA).

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	Character Set	Upper case ASCII, 64 characters
	Character Type	5 x 7 dot matrix
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	Number of Colors	6 colors
Keyboard		49 alphanumeric and function keys
Cassette	Interface	Use various cassette tapes and cartridges as data storage units
Software	Cartridge Interface	
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Display	Interface	Connects to color TV or video display
Remote	Control Paddle	Used for education & entertainment
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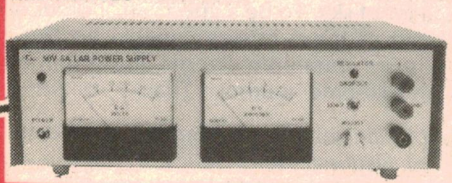
Ref: EA May/June 1983

By far the most exciting high power supply we have seen! Using the latest switchmode principle, very little energy is wasted with high dissipation in the regulators – a cause of considerable heat dissipation and high hardware costs.

The Jaycar kit comes with every originally specified component down to the last nut and bolt. Also included are special Scotchcal meter scales. Beware of inferior kits that do not supply such components. (Not for sale as a separate item).

Cat. KE1520



Breath Tester $24.95

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SAVE $5

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In all states and territories in Australia it is an offence to drive a vehicle with an alcohol/blood concentration above a certain limit. In most states it's 0.05 others 0.08. Either way it's only a relatively small number of alcoholic drinks.

Because it's only a small number of drinks, many people (quite wrongly) believe that they remain below the statutory limit.

The KA1522 Breath Tester can help here. A unit with the same circuit diagram was featured in May "Electronics Australia". It CANNOT give you an actual blood/alcohol content reading, however it can go close. And it can give you a relative reading between inebriated friends!!! Great at parties!!!

Grab the whole kit now for only $29.95. You never know, it may save your licence or your life!

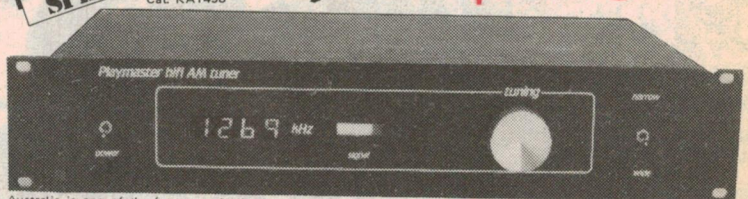
Wide band AM Tuner

Ref: EA Dec-Jan 82-83

POST STOCKTAKE SPECIAL

Cat. KA1498

~~$249~~ $229 SAVE $20



Australia is one of the few countries in the world where wideband AM is transmitted. In fact a good quality AM signal can be much better than its FM counterpart!! Anyone who has suffered from FM multipath distortion will know what we mean. The Playmaster AM tuner is a true broad-bandwidth superhet design. See the frequency response graph in November EA 1982.

Once again, the Jaycar kit is a high quality approach. Jaycar supplies an exclusive front panel design that differs from the original EA design. The Jaycar kit provides all components to complete the project INCLUDING a completely pre-punched cabinet.

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Distortion: 100Hz-0.067% 1kHz-0.007% 10kHz-0.008% (essentially irrespective of cut or boost)
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ALL IC SOCKETS PROVIDED

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"Blueprint" 5000 preamp

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MULTICOLOURED LED DISPLAY

5000 POWER AMPLIFIER

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REF: ETI JAN/MARCH 1981

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BLACK MONOLITH

"BLUEPRINT"

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- MOVING MAGNET (DYNAMIC CART)
- INPUTS (2 OFF)
- TUNER INPUT
- AUX INPUTS (2 OFF)
- TAPE INPUTS (2 OFF)
- INPUT LEVEL CONTROL
- TAPE OUTPUTS (2 OFF)
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- LED AVERAGE (VU) & PEAK
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REF: EA 11/81-1/82

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7½ OCTAVE (88 NOTE) VERSION $489

GREAT NEW FEATURES!!

– FREE! A soldering iron (worth around $19). Yours to keep to give years of faithful service after you have completed your Lyrebird. (88 note only)

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FREE! Quality IC sockets provided in both kits.

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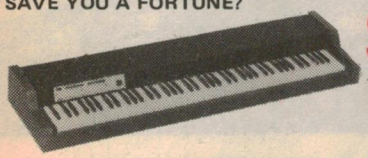

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WITH FREE STAND (not shown)

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The stand that we provide for the piano kit is not shown in the illustration

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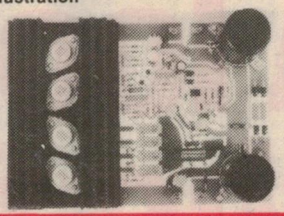

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(Transformer needed. ONLY $39.50)

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NEW

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- Reactive Discharge electronics combining all the advantages of both Inductive and Capacitive Discharge for maximum spark performance.
- Gives the most thorough combustion of air/fuel ratios especially current lean mixture emission controlled engines.
- Voted 'Accessory of the Year' and the best as tested by Popular Motoring Magazine.
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A Reactive Discharge System – with unique auxiliary circuit. Combines all features of the TX1002 plus:
- Active Discharge electronics combining all the advantages of Inductive and Capacitive Discharge for maximum spark performance.
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- Robust die-cast case, fully resistant to moisture and heat.
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TX-1002. Slightly lower powered version of the TX-2002. Ideal for most 4 cylinder cars. All fitting pieces included!
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An Inductive Discharge System
- Can be operated utilising 'Hall Effect' triggerhead, or existing contact-breakers.
- Extended dwell Inductive Discharge for maximum spark efficiency.
- Three position switch.
- Static Timing Light.
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- Robust die-cast case.
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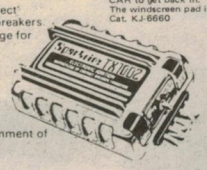

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An aircraft with two fuselages and a common wing would be cheaper to manufacture and maintain than two separate aircraft thanks to the reduction in parts.

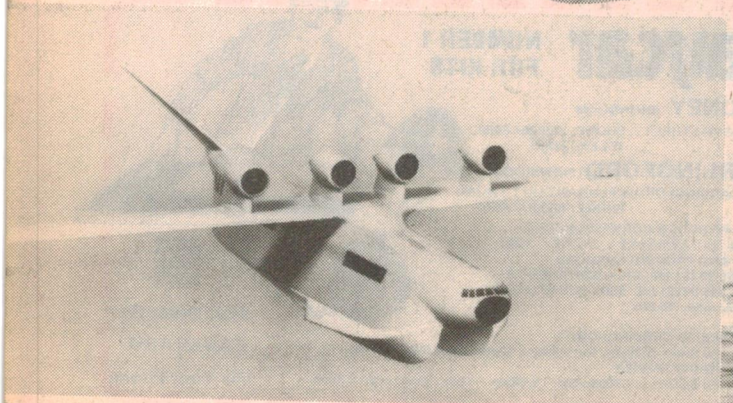
AIRCRAFT DESIGN: A look into the future

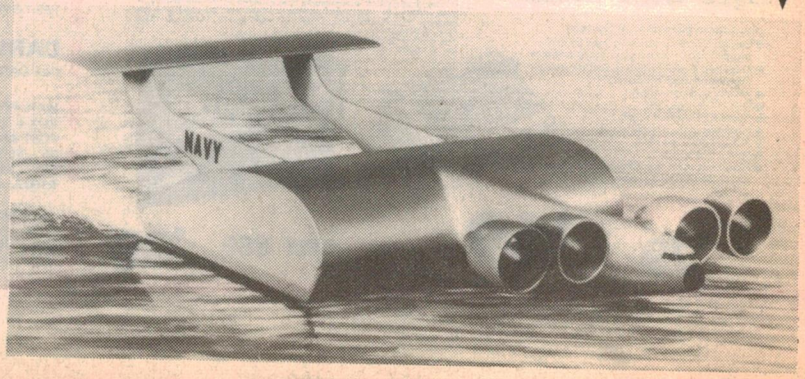
In researching designs for modern aircraft the designer cannot afford to overlook any possibility, no matter how bizarre it might appear. Pictured here are some examples of current thinking.

The delta wing "spanloader" would carry cargo inside the wing. Wing loading is reduced by this distribution of weight and the use of tough carbon composite materials.

Designed for ocean warfare, the "Sea Loiter" amphibian would be able to sit on the water for up to 10 hours at a time between search and combat missions.

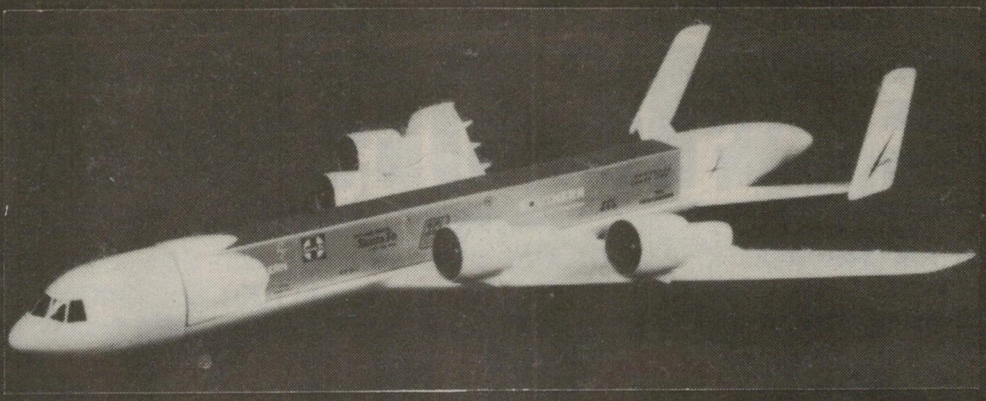
Half aeroplane and half hovercraft, this design for a transport is a "wing-and-ground-effect" machine, capable of 400km/h over open ocean.



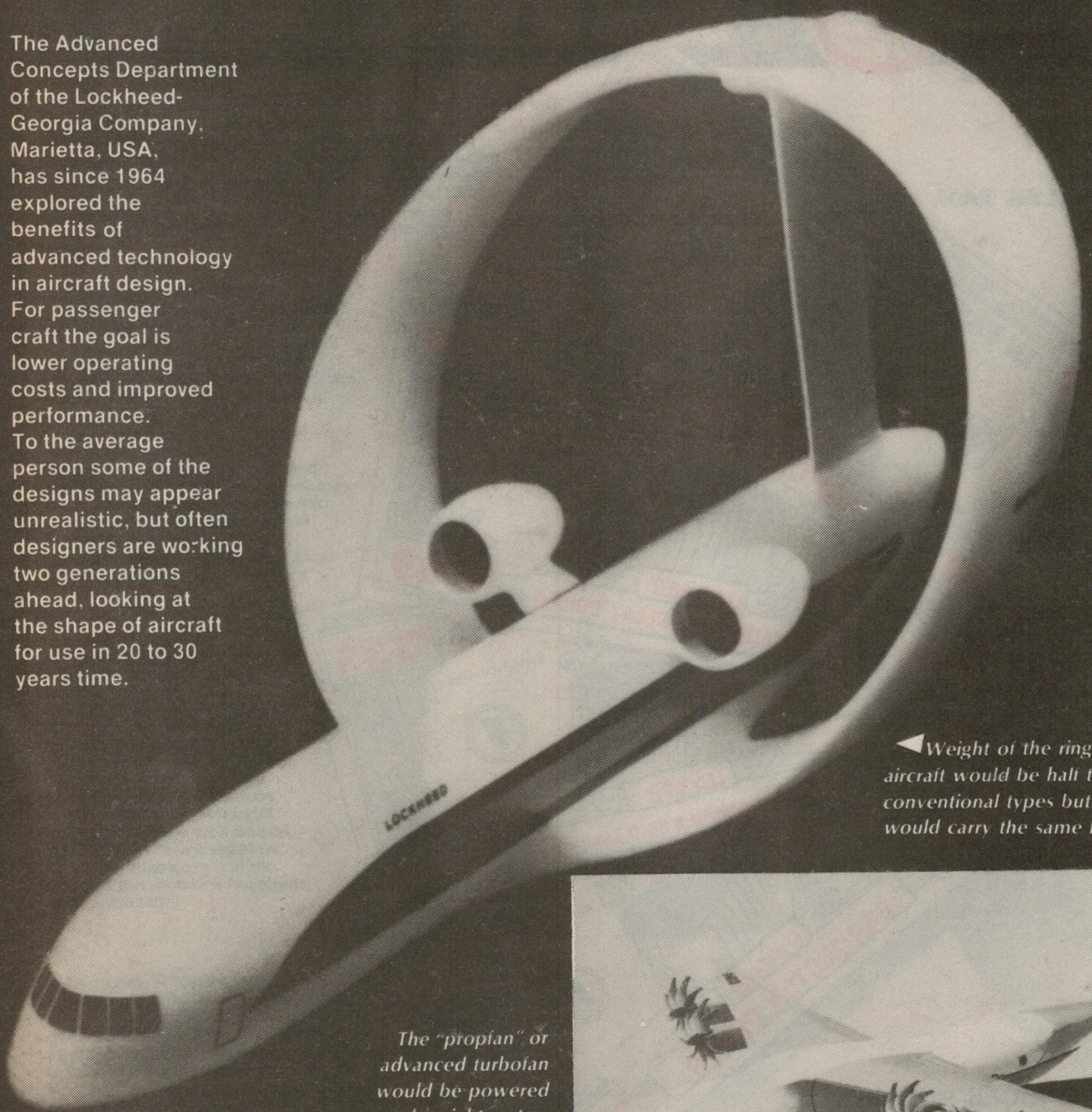


A nuclear-powered plane could fly for as long as the engines were lubricated.

The "flatbed" or container plane could carry cargo or passengers in streamlined modules.

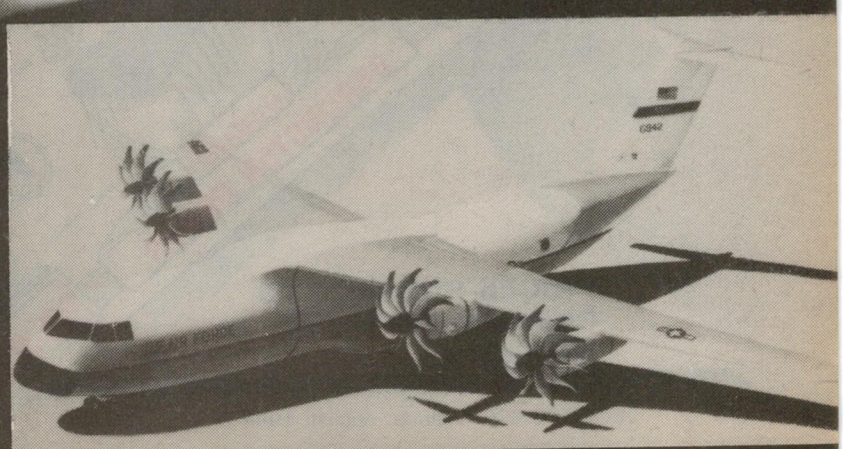


The Advanced Concepts Department of the Lockheed-Georgia Company, Marietta, USA, has since 1964 explored the benefits of advanced technology in aircraft design. For passenger craft the goal is lower operating costs and improved performance. To the average person some of the designs may appear unrealistic, but often designers are working two generations ahead, looking at the shape of aircraft for use in 20 to 30 years time.



Weight of the ring wing aircraft would be half that of conventional types but it would carry the same loads.

The "propfan" or advanced turbofan would be powered by eight or ten-bladed propellers providing savings in fuel and the speed of jet engines.



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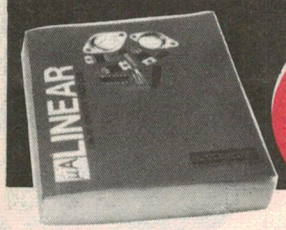

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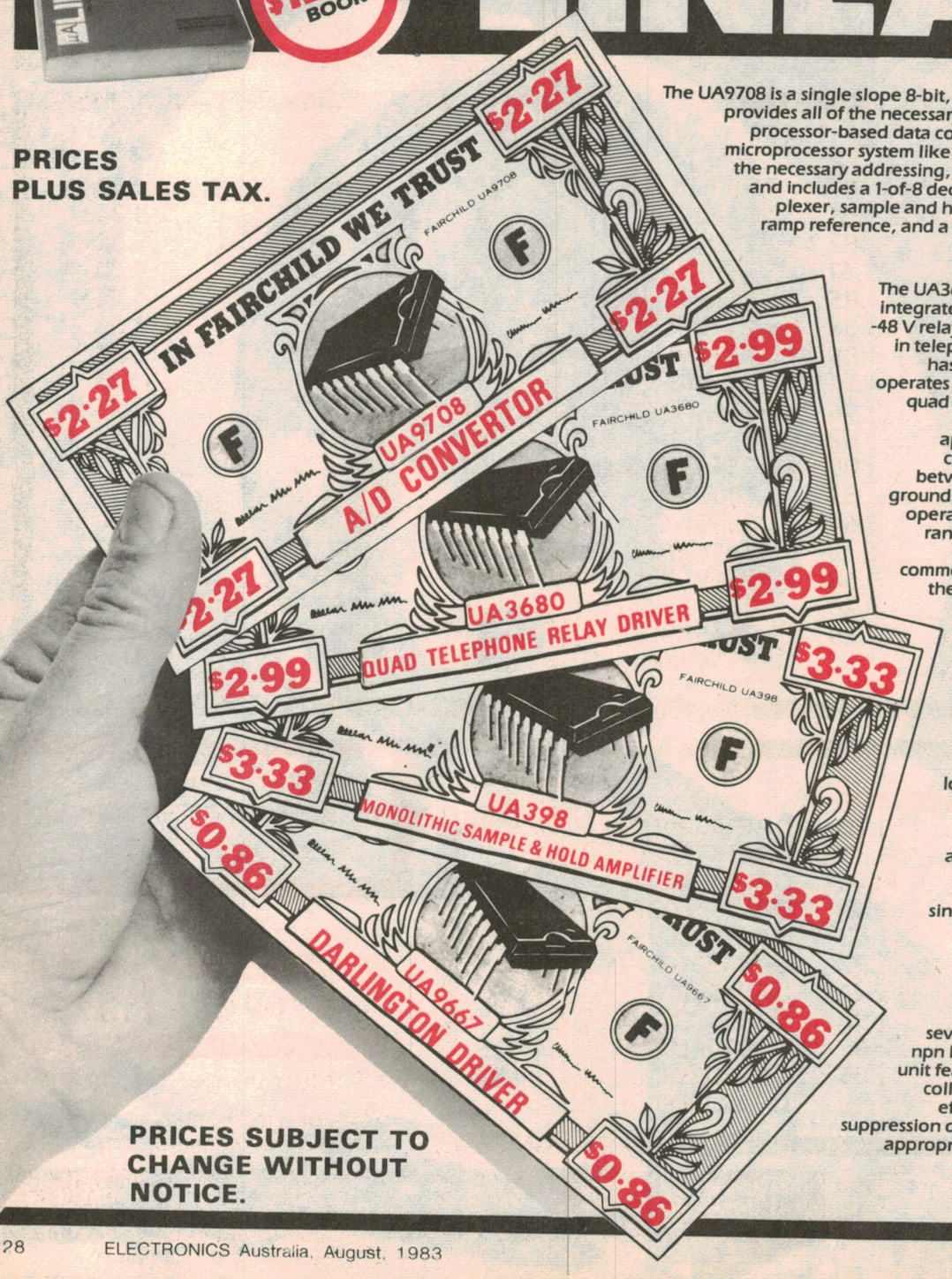

The UA9708 is a single slope 8-bit, 6-channel ADC subsystem that provides all of the necessary analog functions for a microprocessor-based data control system. The device uses a microprocessor system like the F3870 or F6800 to provide the necessary addressing, timing and counting functions and includes a 1-of-8 decoder, 8-channel analog multiplexer, sample and hold, ramp integrator precision ramp reference, and a comparator on a single monolithic chip.

The UA3680 relay driver is a monolithic integrated circuit designed to interface -48 V relays to TTL or other logic systems in telephony applications. The device has a 50mA source capability and operates from -48 V battery power. The quad configuration increases board density in typical line card applications. Since there can be considerable noise and IR drop between logic ground and battery ground, these drivers are designed to operate with a high common-mode range (±20V reference to battery ground). Also each driver has common-mode range separate from the other drivers in the package.

The UA398 is a Monolithic Sample and Hold Amplifier which utilize BI-FET Technology to obtain ultra high dc accuracy with fast acquisition of signal and low droop rate. Operating as a unity gain follower, dc gain accuracy is 0.002% to 0.1%. A bipolar input stage is used to achieve low offset voltage and wide bankwidth. Input offset adjust is accomplished with a single pin and does not degrade input offset drift.

The UA9667 is comprised of seven high voltage, high current npn Darlinton transistor pairs. This unit features common emitter, open collector outputs. To maximize its effectiveness, this unit contains suppression diodes for inductive loads and appropriate emitter-base resistors for leakage.

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INTERFACE

UA1488DC	.87	75107BPC	.61	9636ATC	1.52
UA1488PC	.51	75108BPC	.61	9637ARC	3.26
UA1489ADC	.87	75110ADC	.98	9637ATC	1.52
UA1489APC	.51	75110APC	.72	9638RC	6.13
UA8T26ADC	1.85	75150TC	.76	9638TC	1.73
UA8T26APC	1.56	75154PC	.76	9640DC	1.65
UA8T28DC	1.85	75451ATC	.57	9640PC	1.37
UA8T28PC	1.56	75451BTC	.52	9643TC	5.11
9614DC	1.96	75452ATC	.61	9645PC	2.27
9614PC	1.52	75452BTC	.52	9665PC	.82
9615DC	1.00	75453ATC	.61	9667DC	1.09
9615PC	.87	75453BTC	.52	9667PC	.86
9616DC	8.69	75461TC	.52	9668DC	.90
9616PC	8.18	75462TC	.52	9668PC	.87
9627DC	9.68	75471TC	.61	75107ADC	1.16
9627PC	9.20	75472TC	.61	75107APC	.82
9636ARC	3.26	75491PC	.52	75107BDC	1.16
		75492PC	.52		

DATA ACQUISTION

UA398HC	3.98	DAC1408BDC	1.38
UA398RC	3.33	DAC1408BPC	1.20
UA565	POA	DAC1408CDC	1.26
UA571	POA	DAC1408CPC	1.13
DAC08CDC	1.65	DAC1508DM	4.20
DAC08CPC	1.22	UA96501DC	5.63
DAC08DC	2.61	UA96502DC	4.60
DAC08EPC	1.92	UA96503DC	3.80
DAC1408ADC	2.09	UA9706DC	3.94
DAC1408APC	1.65	UA9708DC	3.47
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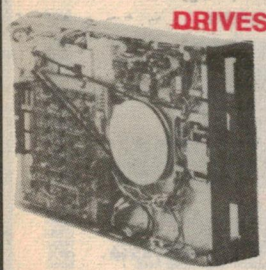

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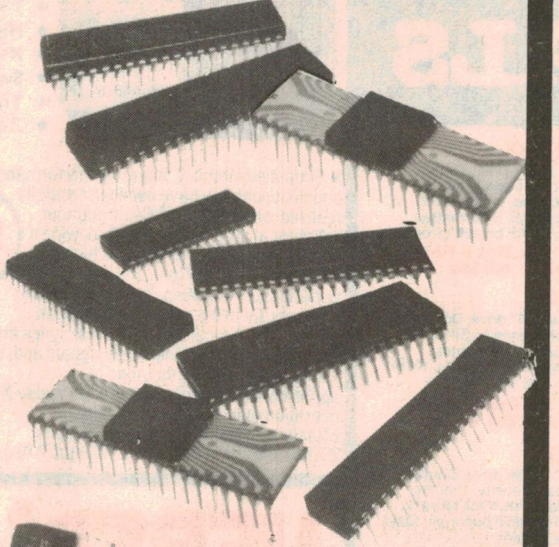

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"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3p

August 1933

Long wave relay stations: No decision has yet been made on the question of introducing long wave broadcasting into Australia, according to Mr H. P. Brown, Director of Postal Services, in his speech at the second annual dinner of the Institute of Radio Engineers, held on August 9.

At the moment, there are 12 national stations in Australia, including relay stations. According to Mr Brown, it would not be practicable, under the long wave system, to erect more than six additional stations, and probably advisable only to use four. Although the advantages of the long wave stations were fully realised by the department any alteration at this stage would mean a dislocation of the radio industry, and of set manufacture, with a probable rise in their cost.

☆ ☆ ☆

Flying Doctor network: Another speaker at the same dinner was the Rev John Flynn, of the Australian Inland Mission, who gave an outline of the work being done in the ambitious project to link up, by radio, the whole of inland Australia, so that at no one spot would a communication post be more than 20 miles away, a project which he believed was soon to become more than a dream.

☆ ☆ ☆

VolksVireless: At par, whatever that is nowadays, the new standard receivers which Little Adolph ordered German manufacturers to make, will sell at 75 marks or £3/16/-. A Professor Leithauser, of the Heinrich Hertz Institute, has been demonstrating the set in a tour throughout Germany. It is a two-valve, AC, or DC model (pentode output), accompanied by an official statement that all concerned made large sacrifices to sell it complete at the above price. Twenty-eight German firms are to manufacture it, and have supplies in time for the autumn show. Herr Nestel, of the RRG Laboratories, is getting out plans for a standard battery receiver.

☆ ☆ ☆

Almost instant playback: The King accepted a copy of the special HMV record of his speech at the Economic Conference; the record was made at the HMV studios, at St John's Wood, by private wire from the Conference Hall, and pressed three hours later, so that the speech might be broadcast by the BBC during the same evening. The record is now available to the public.

☆ ☆ ☆

Getting in early: The president of the American NBC who is also president of the RKO Corporation, Mr Merlin Aylesworth, says that a television studio will be constructed in Hollywood early in the summer.

RADIO TELEVISION AND HOBBIES

August 1958

Man on the Moon by 2000 AD: By general agreement, the Moon will be the first extra-terrestrial body to be directly contacted by man. The most important question is – when?

For thousands of years man has dreamed of going to the Moon. Today that dream is almost a reality. Many of the older people and all of the young who read this will be around when a human being lands on the Moon. This will take place by the year 2000 AD – give or take a few years. It may be longer if wars intervene to halt the rapidly accelerating technological advances. It will be shorter if a technological breakthrough like a nuclear-powered rocket materialises.

Geostationary satellites: Aeronautical engineers have reported an interesting problem involving "Doppler" effect and radio signals.

Two planes closing in on each other and each travelling at 2½ times the speed of sound experience a shift in their radio communication frequencies.

Establishment of two or three satellites 22,000 miles above the earth with instruments for relaying shortwave signals, could overcome this.

The system also could make long-range or even world-wide television possible.

The main unsolved problems are a booster rocket that could get the moderate-sized satellite to the 22,000-mile level, and a means of furnishing the satellite with power to operate its relay equipment.

These problems may be solved in from five to 10 years.

☆ ☆ ☆

BBC colour TV tests: Britain is proceeding cautiously with her plans for colour TV, and has not yet moved out of the experimental field. One big problem concerns the standards to be adopted. This interim report reveals how far the BBC has progressed in this field.

The BBC has issued a report on the series of colour television tests carried out by its staff, in co-operation with the radio industry, up to the spring of 1957. It describes the results as promising, though further experimental work will be needed to resolve outstanding problems concerning mainly the design of equipment. The BBC has formed the opinion that the system used (an adaptation of the American NTSC system) is capable of giving acceptable results.

☆ ☆ ☆

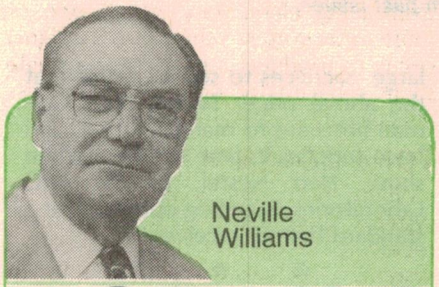
Transistors and rechargeable batteries: Two new all-transistor portable radios, designed to play a minimum of five years on a single rechargeable battery and a cordless transistor table model has been announced by RCA.

Special battery chargers will be marketed as accessories to the new portable radios. The chargers, in effect, transform the portables into AC models while the batteries are being charged.

In addition to operating on the new rechargeable batteries, low-cost penlight or long-lasting mercury cells may be used – thereby assuring the customer of always being able to purchase batteries wherever he may go.

Old circuits never die . . . They are s

Some people take great delight in looking up their family tree — in the case of Australians, to discover on what ship their forebears arrived, at whose expense and whether or not they were wearing leg irons! On the other hand, some prefer to pursue the pedigree of electronic circuit concepts.



Neville Williams

FORUM

One such person, it would appear, is Mr D. C. Sutherland of Wanganui, New Zealand. Strangely enough, we didn't recognise the symptoms, when he first wrote to us earlier in the year. In retrospect, we should have.

His letter began thus:

Dear Sir,

"You will, of course, be familiar with the so-called 'long-tailed pair' or 'Schmitt Circuit', after O. H. Schmitt, who described the scheme in 'Review of Scientific Instruments' early in 1938. This circuit was intended for, and widely used in, valve amplifiers requiring balanced drive to a push-pull output stage. Since then, it has come into widespread use in solid-state circuitry and it is no exaggeration to say that most integrated circuitry, especially of the linear variety, would be impracticable without it.

"For these reasons, it would be well for you to take a look in your files of 'Wireless Weekly' round about May-July 1935 for, in there, you will find prominent mention of what came to be called the 'Barnes Mystery Circuit'. When you look at it, you will see that it works on exactly the same principle as the Schmitt circuit . . . but, because it uses only a common cathode resistor, we might call it a 'short-tailed pair'.

BIRTH OF A MYSTERY!

Our correspondent went on to recount what he understood at the time about the abovementioned circuit: how a certain Mr Barnes, a Queenslander, had noticed that an ordinary push-pull amplifier continued to operate, with only a minor loss in gain and power, when one of the output valves was removed. As a further step, he replaced the valve in its socket, at the same time earthing its grid; it seemed to restore the amplifier to normal, earthed grid notwithstanding!

That led to the concept of a push-pull output stage, as per the circuit at right, having no obvious provision for push-pull signal drive and with the grid of the second output valve simply earthed. Says Mr Sutherland.

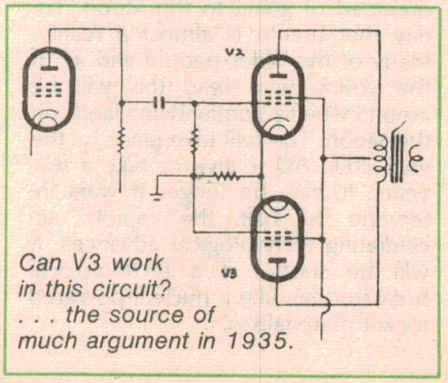
"Appropriately mystified, he communicated his findings to your magazine and set off what must surely be the most lively – even wild – controversy ever in the field of radio technology in Australia, or anywhere else, for that matter . . . hundreds of letters coming in from all over Australia and New Zealand . . . and nobody seemed to be able to speak with the voice of authority to settle the matter once and for all.

"The poor Editor did not seem to know what to make of it and, with the publication of the constructional article in a following issue, the matter was dropped.

"This is a pity because, by the time Schmitt's disclosures had been made some three years later, this interesting bit of pre-history had been forgotten.

"To do something about this has been on my mind for the past 20 years or so. It would be true to say that, today, the name of Barnes and his role in the pre-origination of the long-tailed pair is completely unknown. As an unashamedly chauvinistic Australasian, I feel that justice has not been done and this letter is a first effort to have that position rectified."

Our main reaction to the letter was one of incredulity: surely not again, after nearly 50 years!



Can V3 work in this circuit? . . . the source of much argument in 1935.

The fact of the matter is that the Barnes mystery circuit was perpetuated and cherished mainly by the hobby fraternity. It was never much of a mystery to those engaged in "radio" design at a more serious level and, even if it had been, it could hardly have survived the formal emergence of Schmitt's "long-tailed pair" type of phase inverter three years later, complete with mathematical analysis.

"SOLVED" YEARS AGO

Even so, we sorted out the references required by Mr Sutherland and, as well, enclosed a copy of "Forum" from our July '74 issue. Also prompted by a reader's letter, it was entitled: "A circuit that stumped them in the '30s".

On that occasion, having outlined the emergence of the Barnes circuit, we talked about partial cathode coupling, partial push-pull operation and the fortuitous choice of power pentodes with their naturally high output resistance. The rather tenuous link with the long-tailed pair was duly mentioned. All this, in line with the expressed intention:

"Let's see if we can get rid of the 'mystery' once again."

Our correspondent had, of course, to acknowledge that Mr Barnes' role in circuit history had indeed been recognised and that his electronic whodunnit had been resolved.

But, in the meantime, he had discovered that the "Silvatone" power amplifier, described in the "New Zealand Radio Times" for March 10, 1936, had used cathode-coupled type 56 voltage amplifiers to drive push-pull 2A5 output pentodes. Acknowledged in the magazine as a derivative of the Barnes circuit, it carried a correct (if rather tentative) account of its operation and clearly anticipated the long-tailed pair – two years before Schmitt's paper.

It was about this time that D. C. Sutherland's alter ego emerged from the correspondence. Far from being merely obsessed with long-tailed pairs, he obviously has a penchant for researching and documenting the pedigree of circuit arrangements generally.

For example, when following up the Barnes circuit, he noticed the receiver design which actually won the 1935 "Wireless Weekly" competition for circuit concepts: the "£50 Prize-Winner", designed by P. H. (Peter) Adams, who later became a prominent amateur radio operator and applications engineer for Eveready Batteries.

What caught his eye was the fact that it

mply brought up to date!

used the then new 2A7 pentagrid converter as the frequency changer but with a cathode-coupled Hartley oscillator configuration. That arrangement did not come into wide use until the much later introduction of the 6SA7 which, being a single-ended all-metal valve, lacked sufficient pins for a normal oscillator.

It's the kind of detail that even the great Holmes might have affected to notice.

Our correspondent suggests that Peter Adams opted for the circuit because it would enable constructors to use oscillator coils intended for the still common autodyne frequency changer. But the fact remains (he says) that it is probably the first-ever use of a Hartley oscillator with a pentagrid converter, thus anticipating the 6SA7 and similar valves. It was also commended by K. R. Sturley in his book "Radio Receiver Design, Part 1" as offering a number of advantages.

Our correspondent continues:

"At this point, I can regard my 'dossier' on the Barnes affair as substantially complete.

"Of course, I have other dossiers as well on such subjects as: Superregeneration; Heterodyne and Superheterodyne; Signal Strength Measurement and Standard Signal Generators; Physics of Thermionic Emission and the reverse process; ie the condensation of electrons on metal surfaces and the phenomena of latent heat involved in the respective cases . . . and so on.

For the most part, these dossiers consist of photocopies of articles and papers in such publications as Proc. IREE, JIEE (UK), Physical Review, etc. The material from Wireless Weekly will take an honoured place alongside the rest.

D. C. Sutherland's remarks can hardly fail to stir the long-time interests and aspirations of old-timers in the electronics industry. Who amongst us can resist the lure of the past? But then who amongst us has escaped the domestic pressures to "get rid of all those dusty old books and papers"?

Maybe we should get them all together in one place, load them aboard a 747 freighter and despatch them to Wanganui!

But seriously: The letters did strike a chord of memory about another potential "we-did-it-first" claim from the EA stable: one to do with audio tone control systems. We recollect having speculated about it on a previous occasion, but when and where escapes us for the moment.

Maybe D. C. Sutherland would like to open a new dossier on the subject!

Back in the early '30s, tone controls were quite elementary affairs: one or more capacitors switched across a signal circuit to produce treble cut, or a single shunt capacitor rendered more or less effective by a variable series resistor.

TONE CONTROLS?

When more ambitious tone control systems were required for up-market receivers and amplifiers, switched systems were usually preferred for at least two reasons:

1. They were able to effect complex circuit changes to achieve the desired end result;
2. The switches could have a true neutral centre position with identifiable amounts of boost and cut to either side.

We were still using switched tone controls in "Playmaster" control units up until the middle '50s but they were tending to lose favour because of their abrupt control action and their tendency to produce audible clicks. Moreover, by then, smooth, comprehensive and click-free control had become possible using normal potentiometers, in association with capacitors.

The Radiotron Designer's Handbook (by F. Langford-Smith, Fourth edition, 1952) has a comprehensive section on tone compensation and tone control. The earliest listed reference to a potentiometer type boost/cut control was in an Australian ARTS & P Bulletin, Nos. 27 and 28, April and May 1936. It showed a compound tilt control: treble up-bass down/treble down-bass up.

The first reference to a straightforward treble cut/boost control reads: "Williams, W. N., Two High-Gain Amplifier Circuits", Radio & Hobbies, June 1942. The ARTS & P paper clearly anticipates this, except that they had chosen to fiddle the bass response simultaneously with the treble.

However, when it comes to providing full bass and treble, boost and cut – in the modern manner – using potentiometers and capacitors, the listed references start in 1945/46 and proceed from there.

But, two years earlier, in June 1943, we had described the "TRF Fidelity Nine" receiver, featuring separate bass and treble, boost and cut, using potentiometers and capacitors. I can't remember all the circumstances but the descriptive text strongly suggests some original thinking:

FORUM *Continued*

6 If only a scheme could be devised which would give not only independent bass and treble boost, but also bass and treble cut using potentiometers; a scheme which would not require troublesome inductors and hard-to-get switches.

After much scheming and sketching of circuits, what seemed like a workable arrangement was evolved. Tried out in practice, and slightly amended here and there, the control worked like a charm.

It requires two tone control knobs, one for treble, one for bass. Rotate the treble knob in one direction and up come the highs. Turn it to the opposite extreme and they are attenuated; in between are intermediate positions and a position in which the overall response is level.

Rotating the bass knob through its extremes has precisely the same effect on the lower frequencies. The two controls are substantially independent of one another.

In the same June 1943 issue, we featured the circuit on its own as "A New Universal Tone Control Stage". Some time later, in December 1944, we reprinted the tone control circuit and suggested an up-date which would provide a stage gain of about three times, rather than a loss, as previously.

As I remember it, this is where we left matters on the previous occasion and it leaves the question open for the Sutherlands of this world:

In April 1943, when we would have actually contrived the universal potentiometer/capacitor tone control system, we clearly saw it as an original effort. Was it really the birthplace of the now almost universal inclusion in amplifier systems or were we unknowingly reinventing the wheel?

On the subject of inventing things, incidentally, a suprise may await anyone who invents a torch capable of projecting a beam of non-light, or darkness. Something of the kind was announced in July 1935 by the English journal "Practical Television".

They reported a new, portable TV receiver using a miniature cathode-ray tube projecting on to an external folding screen. The picture would be visible because of a provision to project intense shadows on to the screen, revealing a picture that would otherwise be insufficiently bright!

Meanwhile, on the subject of sidebands. . .

Incidentally, our correspondent sought also to buy into the recent discussion about sidebands, pointing out that he is the same D. C. Sutherland who raised the matter in "Wireless World" with a letter to the Editor published in June 1982. This prompted an article in the October issue of the same magazine: "Sidebands: Past, Present and Future", by Professor D. A. Bell.

We resisted the temptation to publish that section of the letter, primarily because we have chosen to close correspondence on that subject for the time being and we have to be fair.

However, to expand rather than simply protract your thinking about sidebands, it is pointed out that the subject takes on a whole new dimension if one breaks out of the habitual assumption that the modulation (audio, video, etc) automatically involves a lower frequency than the carrier.

This need not be so and, in the case of a carbon microphone, a class-A amplifier, or a human voice, the thing modulated is an unvarying (zero frequency) carrier: a stream of electrons, or a stream of air.

If this seems to imply a mathematical requirement that one sideband component must end up as a negative frequency, Professor D. A. Bell (referred to above) appears to find no difficulty.

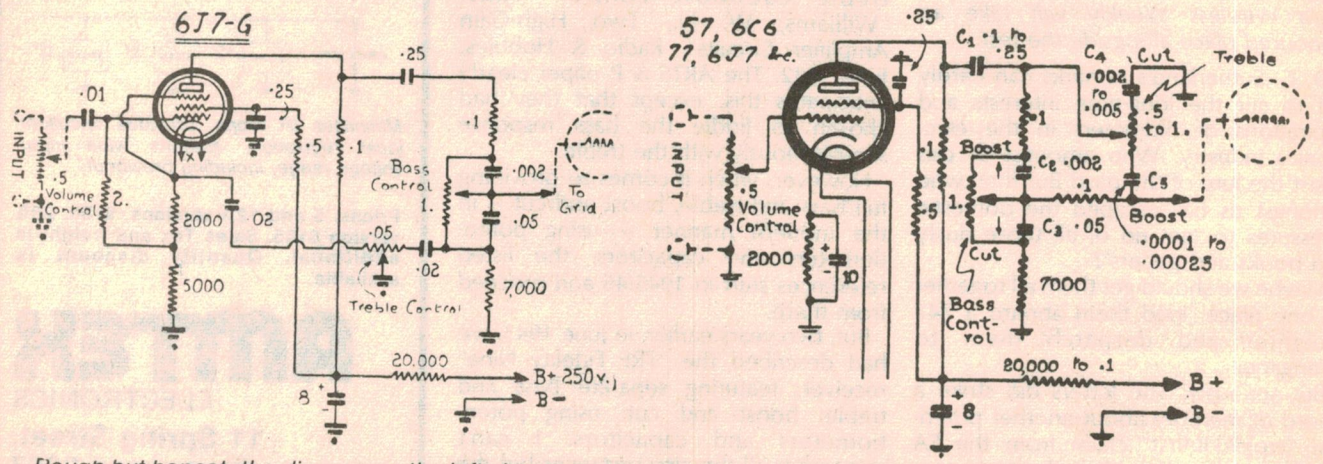
In fact, Sutherland points out that he recently came across a reference to a "definitive mathematical exposition" of the concept developed a very long time ago: a paper by Dr G. A. Campbell, quoted in "A History of Engineering and Science in the Bell System" Vol 1, page 901.

That tends to be getting rather abstract but what you may find intriguing, if you haven't thought of it before, is D. C. Sutherland's reference in his "Wireless World" letter, to the role of a magnet in a transducer: "Consider further that proper reconstruction of a baseband signal to (say) audible form requires reinsertion of a zero-frequency carrier eg in the polarising field of a loudspeaker!"

For many, it will be a new notion but, in a roundabout and even superficial way, the remark ties in with what audio types have been doing for years: putting polarity markings on loudspeaker voice coil connections. Put plus to plus and the cone moves forward (positive acceleration); reverse the drive and the cone moves backwards (negative acceleration).

Yuk. Now I'm not sure whether I'm enlightened or confused!

Who pioneered the potentiometer/capacitor universal tone control?



Rough but honest, the diagram on the left shows a potentiometer/capacitor universal tone control stage featured in our June 1943 issue. On the right is a modified, higher-gain version published in December 1944.

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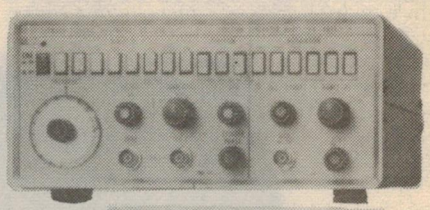

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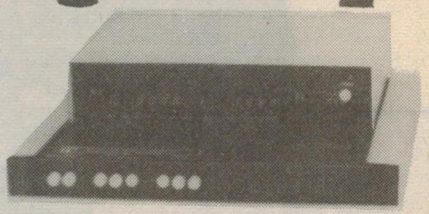

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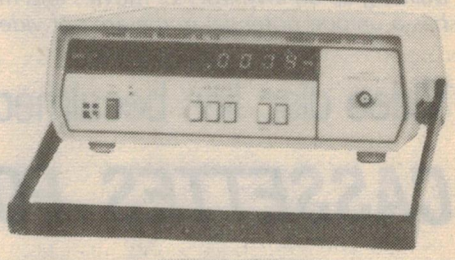

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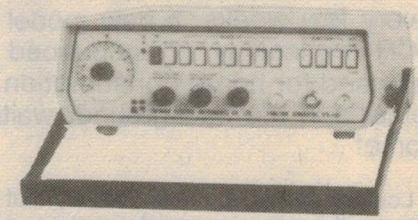

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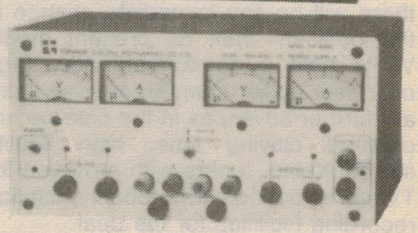
- 4 Indicating meters.
- Aluminium case for good heat dissipation.
- CV, CC and overload indication LED.
- Compact size.



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- Constant voltage, constant current.
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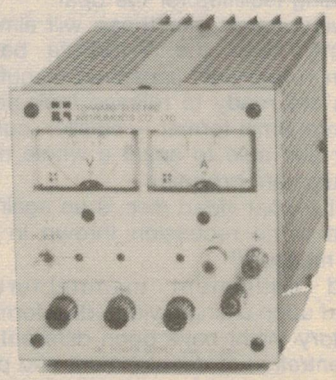

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Pioneer is probably the most active supporter of the laser video disc. They are building up an inventory of movies and musicals but are well aware that the system has a unique potential in the area of video games, tuition and information storage.

Video disc lies becalmed while . . .

CASSETTES FORGE AHEAD

Every few weeks, a new model VCR appears on the market, new VCR technology is announced or a new batch of cassettes is released for home consumption. And, all the while, the video disc remains in the background, waiting for a day that never seems to come!

Looking ahead, it seems unlikely that there will be any immediate change in the position. Just as present model VCRs hold a comfortable advantage over their earlier counterparts, so there are further advances in the pipeline: increased playing time, high fidelity stereo sound, tuners with provision for TV stereo sound and, probably, caption recording facilities for the deaf.

Developments like those will almost certainly keep the VHS/Beta bandwagon rolling until Japanese manufacturers are ready to release their new, universal 8mm format — smaller, cuter, better and able to spark a whole new re-equipment program.

That's what video disc is up against, with a world recession thrown in for good measure!

Had equipment manufacturers agreed upon a single video disc format, the story might have been different. A concentration of development and promotion on a single system could well have brought it forward in time and pinned back the market advantage that the cassette system has since established. Even now, some rationalisation may still occur — but of desperate necessity!

It is ironic that, having learned their lesson the hard way, equipment manufacturers did finally settle for the compact disc is in the audio field, using technology originally developed for the laser optical video disc. Now, while the compact disc looks all set to "take off" in the marketplace, its video counterpart still struggles for recognition or, perhaps, for a modified role in the scheme of things.

It is likewise ironic that, although there are three major VCR formats battling for supremacy — two in Australia: VHS and Beta — research and development still tends to serve a common cause. The systems are physically incompatible but they are quite similar in terms of basic principles. It doesn't take too long for ideas and improvements for any one system to flow over into the other two. And a problem solved for one is a problem solved for all.

by NEVILLE WILLIAMS

Over the two or three years that VCRs have been in the Australian marketplace in quantity, we have seen new facilities added, first in one system, then in others — beginning at the top-of-the-line models and gradually working their way down the price range. And that is likely to continue into the future, as already indicated.

DESIGN TRENDS

National provide a good barometer of what is going on in the VCR field (a) because they are market leaders in Australia and worldwide and (b) because National/Panasonic/Matsushita owns a controlling interest in JVC which, in turn, controls the key patents for the dominant VHS system. They are in a good position to both discern and shape trends.

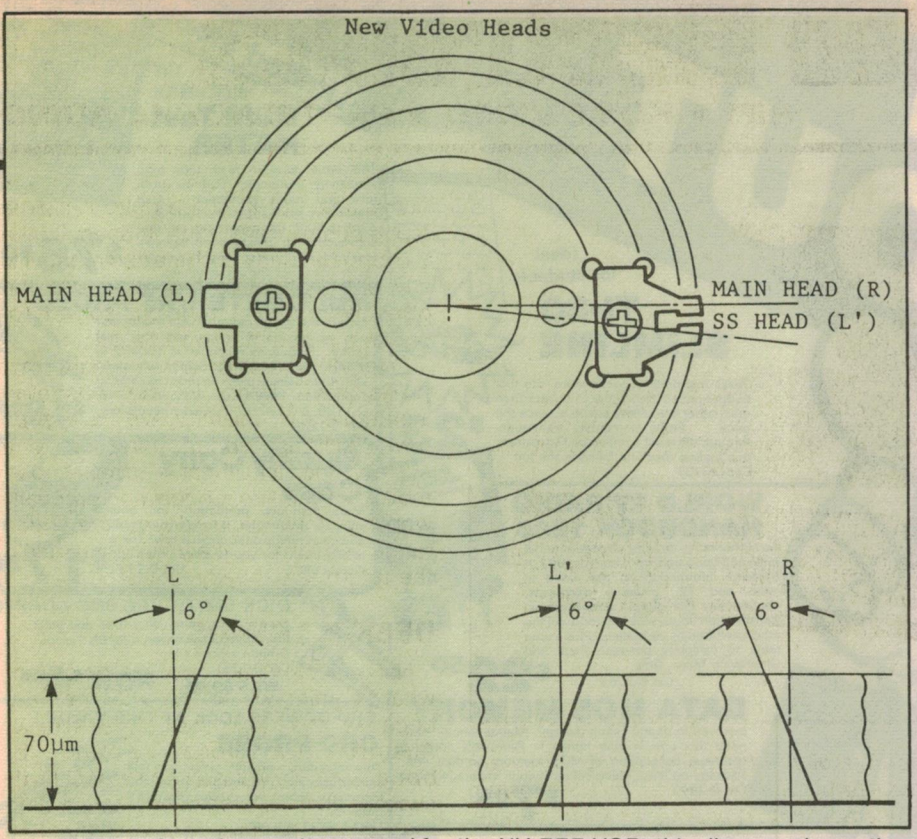
National's current top-of-the-line model NV-777 offers most — if not all — of the features which VCR buyers have been looking for up to the present. What is not so evident is that the design prepares the way for the models which will follow it off the production line shortly, offering extra features at (we imagine) extra cost.

The most striking — and significant — feature of the present NV-777 is its ability to produce virtually jitter-free still and slow-advance pictures, even from scenes containing considerable movement. There may be smear resulting from the virtual 1/50th second exposure of any movie system, but there is no inter-field jitter. National achieve this by creating an ostensibly normal interlaced picture from a single TV field.

The provision itself is not unique but it usually involves two extra heads on the video drum for the still/slow function. National achieves the same result with two heads only, one being a double-gap type.

Fig. 1, reproduced from the service manual for the NV-777, shows a plan outline sketch of a video drum with two heads attached. (The drum spins in an anti-clockwise direction, as viewed, while the tape, contacting the lower rim of the drum, would be moving from left to right in forward play.)

What National refer to as **"Main Head L"** is on the left. On the right and



Reproduced from the service manual for the NV-777 VCR, this diagram shows the position of the heads on the drum and their gap azimuth angles.

precisely opposite is **"Main Head R"** with an extra pole face immediately below it marked **"SS (Still/Slow) Head L' "**.

For the sake of clarity, both head assemblies are shown larger than they really are, in respect, to the drum, as also is the separation between the main head **R** and the adjacent SS head section **L'.** In fact, the actual radial distance between the two gaps is a mere 620μm or 0.62mm. We shall say more about this dimension a little later.

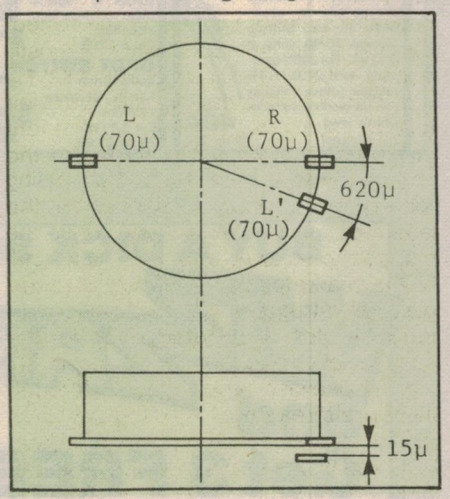
The other important point is that the gap azimuth of SS head **L'** is at the same inclination as that of main head **L,** and therefore rotated by 12° from main head **R.** (See diagram).

RECORD, PLAY MODE

In ordinary record or play mode, the NV-777 uses only the two main heads **L** and **R** to lay down and replay tracks for the alternate picture fields. They are also used for the Cue and Review functions; In these modes, the NV-777 operates much like any other VCR.

And, like any other VCR, the NV-777 encounters a potential problem when the tape is stopped in the Pause/Still playback mode: the path which the heads follow across the tape does not exactly coincide with tracks recorded when the tape was moving. In fact, the heads tend to skew obliquely across the recorded tracks, including segments which they cannot read because of the wrong gap azimuth. This results in bands of noise across the picture — a familiar occurrence in most older model VCRs.

Various schemes have been devised to minimise the noise bar problem, one of them being to fit video heads having gaps much longer than necessary to lay down the appropriate width of track — 49μm in the case of PAL format VHS VCRs. The practice does not breach standards, because the wider track is automatically reduced to 49μm when the surplus trailing edge is over-



Separation between the head gaps R and L' is a mere 0.62mm but it is still enough to cause a 2-line delay, which needs to be compensated in the circuitry.

recorded by the following adjacent track.

The important thing is that, for playback, the longer gaps straddle more than the bare 49μm of track width, giving them a better chance, during "trick" play modes, of scanning track segments which they can read, while still rejecting those which present the wrong track azimuth.

In the National NV-777 all three head gaps are 70μm long, but that is only the beginning. The tape drive servo system is so arranged that, when the deck is placed in the Pause/Still mode, the tape comes to rest with the main head **L** reading a track with the appropriate azimuth. Because the gap length exceeds the track width by a considerable margin, it can read the full length of the track, even though the respective paths are diverging with the tape at rest.

While that ensures one complete picture field via main head **L,** main head **R,** following the same path across the stationary tape would contribute mainly noise, plus fragmentry signals from as much of the adjacent tracks as it could read.

HEADS ARE SWITCHED

However, in the NV-777, it doesn't get the chance to do so, because switching to Pause/Still mode diverts that section of the playback circuitry to SS head **L'.** Because head **L'** has the same gap azimuth as main head **L,** it reads the same signal, which is then used to build up the alternative picture field. The receiver therefore displays what appears to be a fully interlaced picture, with no risk of inter-field flicker.

What of the 620μm separation between the heads gaps **R** and **L'** ?

At first glance it may seem to be negligibly small but it turns out not to be so when it is remembered that one entire picture field of 312.5 lines is packed into a single 99mm sweep across the tape.

Calculation will show that a radial displacement of 620μm would be equal to 128μS or two scanning lines. In this case, there would be a two-line lag in the luminance information fed to the fill-in field, creating a potential source of jitter — even though minor — and some possible ambiguity In the sync pulse train. National have anticipated this with in-built compensation circuitry, plus an adjustment, accessable to servicemen installers, to ensure optimum stability with any given receiver.

The Frame Advance and Slow modes are extensions of the Pause mode in that the tape nudges forward by two fields, at the push of a button, or automatically as appropriate. What the viewer therefore sees is a succession of jitter-free stills — which is the nature of a motion picture anyway!

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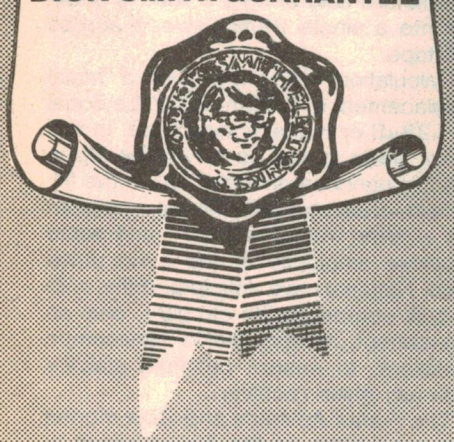
- We stock the widest variety of quality electronics for the hobbyist and professional alike.
- We proudly stand behind every item we sell and back this up with our exclusive 7 day satisfaction guarantee.

That's the DICK SMITH GUARANTEE



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Multi Test METER

This large, easy to read, ultra high sensitivity multimeter features both fuse and diode protection. Also measures capacitance in two ranges ... 50pF to 50uF, has a transistor checker and much more! Complete with batteries test leads and instructions, this multimeter does just about everything.

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$76.50

Ideal for students

TI-30 SLIMLINE

SCOOP PURCHASE!

Texas Instruments packs more into this budget priced slide - rule calculator than most other manufacturers do at twice the price ! From elementary arithmetic, through the most complicated situations, this feature machine handles the lot!
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MULTIMETER/RF PROBE

Extend the useful range of your multimeter way up into the RF range with this neat probe. Frequency response is 150kHz to 30MHz (ref. 500kHz). Comes equipped with 4mm banana plugs for direct multimeter connection. Ideal for use with our Q-1140, Q-1136, Q-1120, or Q-1024 multimeters.
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Quality Carry Case

More than just protection for your valuable multimeter, it keeps your leads and instruments neat, clean & tidy. There is also room for you to store notes and cicuits etc.
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WORLD TV RADIO HANDBOOK 1983

An authoritative directory of international radio and television, up-dated for 1983; it contains information on the world of radio and TV, includes addresses, frequencies, call signs, identifications, transmission times, plus lots more.All the articles written by specialists. Plus a time table to calculate between local and Greenwich Mean Time.
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Own a Dick Smith CRO? Use this great little adaptor to convert it for BNC plugs. Limited stock ! ! !
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WAS $9.95 NOW $4.95

DATA MOS MEMORY

Involved in digital circuit design? Maintenance? You'll need this one in your library ! Fairchild's complete technical description of MOS memory product line. Package outlines, electrical behaviour, etc are included.
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CRO OWNERS LOOK AT THIS VALUE !

CRO PROBE

This incredibly versatile probe set will suit virtually any CRO and give you all the features of a probe set you would pay $$$ more for !
Here's what you get:
Basic probe with inbuilt x1/x10 switch, 1.5 metres of cable, complete with coax type CRO connector and wandering earth lead with aligator clip.
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WAS $35.50 **$29.95**

PLESSEY FOSTER SPEAKERS

Famous brand Plessey Foster Speakers at a ridiculous bargain price ! Huge scoop purchase of distressed stock... -you reap the benefit 8 ohms impedance, handles 6 watts. Fantastic replacement, ideal for new projects too.
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27 MHz TX / RX TESTER

This tester has been specially developed for the servicemen to facilitate the location of faults in hand held transceivers, etc. It can also be used on base stations up to 5 watts.

$69.50

FEATURES:
● Measure power output up to 5W ● Standing Wave Ratio, VSWR from 1:1 to 1:3 ● Modulation percentage 0-100% ● Relative field strength ● Generate 27MHz RF for receiver tuning ● Check crystal activity ● Generate af modulated 27MHz ● Generate a 1000Hz signal for audio testing ● Act as a dummy load for testing transmitters up to 5W.
Cat Q-1380

Miniature Relay

Small in size , but very handy contact rating. The silver plated SPDT contacts will handle up to a massive 2 amps (at 24V DC or 100V AC). Nominally 8 to 12V operating, but will work OK up to 15 volts.
Cat S-7120

$2.25

NEON BULB

Small pigtail type neon bulb as used in indicators timing circuits, oscillators, etc, etc. Striking voltage 70-90 volts at 600 uA. For 240V operation use 270k 1/4w resistor (other voltages can be worked out from Ohm's law.)
Cat S-3862

40¢ 10 up 35c

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Has many many uses but is ideally suited to replacement of desk light switches.
Cat S-1205

$1.40

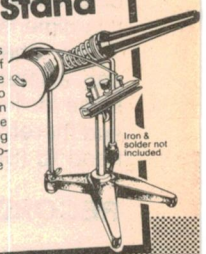
DPDT SWITCH

Body 13mm x 13mm, clearance 17.5mm.
Cat S-1174

$2.45

10 up $1.95

Multi Purpose Stand



● Holds boards and components firmly in rubber faced vyce ● Angle of vyce may be varied widely in three dimensions for greatest accessibilty to board ● Convenient soldering iron holder also adjustable ● Adjustable spool holder for solder and desoldering wick ● Ideal for hobbyist or professional ● Leaves both hands free
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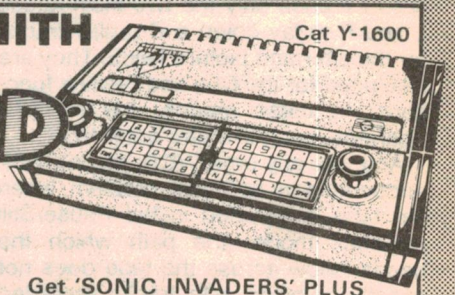
$24.50

BUY A DICK SMITH WIZZARD and Get 3 FREE Cartridges ONLY $295



Cat Y-1600

Get 'SONIC INVADERS' PLUS ANY other 2 games cartridges FREE

For a limited time only, buy the incredible Dick Smith Wizzard, and receive the popular 'Sonic Invaders' cartridge PLUS any other 2 games cartridges of your choice...FREE!

That's $119.85 worth!

DICK SMITH ZIPPY BOXES ORIGINAL & BEST

There is only one genuine 'Zippy Box' - the one with the all-round deep ribbing. Don't be fooled by inferior copies-this is the one used by the major electronics magazines because of its versatility. Insist on the one and only - genuine - Zippy Box from Dick Smith !

LARGE SIZE RANGE AVAILABLE!

Small-UB5 (28 x 54 x 83mm)
Cat H-2755 **$1.80**
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Medium-UB3 (41 x 68 x 130mm)
Cat H-2753 **$2.25**
10 up $2.05

Large-UB1 (50 x 90 x 150mm)
Cat H-2751 **$2.80**
10 up $2.55

Giant-UB2 (60 x 113 x 196mm)
Cat H-2752 **$3.99**
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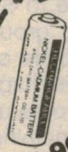
NICADS ARE CHEAPER!



Despite their initial higher price, NiCads work out much cheaper in the long run because they can be re-charged up to 200 times. Rated at a massive 500mA/h, this battery is suitable for almost all devices using standard AA batteries. 1.2 volts. Cat S-3300 **$1.90**

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Ideal cable for use with Hi Fi systems for speaker connections or with intercoms. Twin plastic insulated conductors.
Cat W-2010 **18¢ metre**
$12.00 100m roll

SHIELDED AUDIO CABLE

PVC covered, light duty, very flexible cable that is ideal for patch cords, small microphones, etc. Colour - Grey
Cat W-2030 **30¢ metre**
$25.00 per 100m roll

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Cat W-3022 **$2.00**

SAVE ON TEST CLIPS

IC TEST CLIPS

Similar to the popular E-Z hooks, but cheaper. Ideal for working with small components, easy to solder to. **95¢**
RED: Cat W-4580
BLACK: Cat W-4582 **10 up 75c**

WALL BOARD CLIP

Mount power outlets, switch plates, etc on any cavity wall. (other than brick) without the need for a mounting box. Cat P-5530
95¢ **10 up 85c**

AMAZING VALUE

QUALITY 240V PRODUCTS

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Mount power points, plates, etc on any surface including brick. Cat P-5531 **$1.75**

JUNCTION BOX

Standard electrical wiring junction box with connectors.
Cat P-5625 **$3.20**

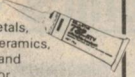
BLANK PLATE

Same size as power point, but blank: ideal for gap filling when you move points, switches etc.
Cat P-5535 **$1.95**

SERVICING AIDS

SILASTIC

Adheres to metals, glass, paints, ceramics, most plastics and wood. Ideal for mending leaks. General purpose one part silicone rubber.
Cat N-1225 **$4.00**



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Top qualityPVC tape. 18 metres longx19mm wide x 0.2mm thick. Hundreds of uses.
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Known to one and all as the 'Dick Wick', this is a specially treated copper braid that is used to remove solder from the PC board by capillary action.
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No soldering, no de-soldering, no heat spoilt components. Accepts transistors IC's LSI packages, resistors, capacitors, LED's, trimmers, relays etc. Base board has 290 holes and pack includes two clip-on extensions each of 50 holes. 390 holes in all.
Cat P-4614 **$9.20**

The Exclusive DICK SMITH SOLDERING STATION

The Dick Smith Auto Temp temperature controlled soldering station offers the serious professional or hobbyist the best quality at an unbelievably low price. Why pay more when you can get these features: Fully variable temperature control (from around 200 to over 500 degrees C.), Temperature meter and Fully approved by the Energy Authority. Complete with lightweight iron, iron holder, cleaning sponge and instruction manual. Cat T-2000 **$65.00**

ACCESSORIES

Replacement Tips:		
Medium Chisel	Cat T-2002	$3.20
Thick Chisel	Cat T2004	$3.20
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Cat T-2010		$1.50

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Primary: 240V, 50Hz
Secondary Voltage: 6.3 7.3 8.5 9.5 12 & 15V.
Secondary Current: 1 Amp
Terminations: Solder Lugs

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3 PIN LINE SOCKET P-1620	$4.95
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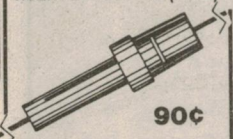
Standard flat blade screwdriver, with neon indicator to warn of dangerous voltages. Cat T-4005 **$1.20**

FUSE HOLDERS

INLINE HOLDER (3AG)



90¢

Suits 3AG fuses, complete with 600mm lead at no extra charge. Spring loaded for sure connection.
Cat S-4277

SAFETY FUSE HOLDER (3AG)

$1.15

This is a professional looking black square panel mounting fuse holder with a coloured 'push-in' insert. The fuse carrying insert is released at the touch of a screwdriver for easy replacement of blown fuses. Gives projects a modern finish. Cat S-4204

TOP VALUE HEATSINKS

Powerfin for TO-3

It has a unique fin design that gives a very high air to metal ratio (thermal rating approx. 5 degrees C/Watt). Measures only 50mm square x 25mm high, pre-punched to suit TO-3 case.
Cat H-3400 **$1.95**
10 up $1.80

Round TO-5

Manufactured to exacting tolerances to ensure a snug fit and best possible heat transfer on TO-5 cases.
Cat H-3412 **55¢**
10 up 50c

Heatsink Clip Set

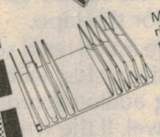
Spring loaded, plier grip clips for heat sensitive components and leads. Made of aluminium for high thermal conductivity 2 types, one straight and one angled, both 75mm long.
T-2620 **$1.60**

Extra heavy duty Powerfin Heatsink

The big one! For when you've got to get rid of a lot of heat. Huge 725mm long, radial fan pattern for optimum efficiency.
Cat H-3426 **$9.75**

Versatile Power Heatsink

Mount it either flat on a panel, or at right angles. The side fins have a tongue and groove so they may be joined sideways. Drilled takes 2 x TO-3's. Size is (mm) 78 x 110 x 33.
Cat H-3460 **$5.75**



Flag Type

Flag type heatsink suits older style germanium transistors (TO-1): OC74, AC128, etc.
Cat H-3480 **20¢**

FANTASTIC VALUE

FLASHING LEDS

Amazing! Inside this standard size (5mm) Red LED is a tiny microcircuit which causes it to flash! All you do apply voltage. Think of the dozens of applications where a flashing warning is needed. WAS 45¢ NOW **35¢**
Cat Z-4000
Ask for FREE Flashing Led Data Sheet containing circuit ideas PLUS specifications!

DICK SMITH ALKALINE LONGLIFE BATTERY

At last! An alkaline long life battery you don't have to pay the earth for! Dicks' own long life-quality made in Japan, and guaranteed 'fresh as a daisy'! At present only size available is AA (penlight), but we hope to introduce more sizes shortly. Come in blister packs of two batteries.
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ROCKER SWITCHES

ILLUMINATED DPDT (240V Neon lamp)

Positive action, handsome black body, bright red illuminating rocker switches, 15 amps! The terminating lugs on the switch will accept standard utilux spade clips. Mounting is push in snap lock.
Cat S-1506 **ONLY $2.95**

ILLUMINATED SPDT (240V Neon lamp)

Attractive oblong shape black switch with red illuminating rocker. Terminal lugs accept Utilux spade quick connectors. Mounting is snap lock.
Cat S-1503 **NOW $3.50**

DICK SMITH ELECTRONICS

See page 98 for full address details

As an additional refinement, the **L'** gap is placed 15μm down from the alignment of the **R** gap, allowing it to make the transition between fields with less chance of losing signal. The risk of introducing a noise bar during the transition is therefore minimised.

So much for the NV-777 and its three-in-two head system, which must be acknowledged as a clever scheme in its own right. Once the production of the dual head was sorted out, National were in the happy position of being able to claim the advantages of a four-head system without the customer apprehension of needing to replace four heads when wear had taken its toll.

HALF-SPEED OPERATION

But it now transpires that National had something else in mind.

They would have known that other PAL format manufacturers were moving towards half-speed record and playback, in order to get four-six-eight hours from existing two-three-four hour tapes — something that is commonplace in the NTSC format markets.

Because the lineal speed of the tape is halved, the video track width is also halved, in the case of standard PAL to about 24μm. This involves some reduction in signal/noise ratio and, to minimise the loss in performance, different heads should ideally be used with proportionately shorter gaps. This leads to a problem, in that it becomes impractical to accommodate on the drum pairs of heads for two speeds and for trick modes in both speeds; that could add up to eight in all.

National appear to have neatly solved that one with their three-in-two head system. By mounting two sets of heads on the drum, one set with short gaps, they would have six functions in four heads, with the capacity for optimum quality record/play and jitter-free Still/Slow at both normal and half speed.

Nor is that the end of the matter.

Some time back, Sony startled the industry by announcing that they had developed a true, high fidelity sound system for the Beta format. It involved impressing two or even three FM sound carriers on the tape, along with the video signals, the sound carriers being located in a non-critical frequency band between the video luminance and chrominance signals. The new system, Sony said, would offer performance consistent with full hifi standards.

CHALLENGE TO VHS

They further "stirred the pot" by stating that the method would not be available to VHS manufacturers, since the format would not accommodate extra sound carriers. However, JVC and Matsushita took up the challenge and, within a fairly short time, demonstrated VHS high fidelity stereo sound, apparently giving the lie to Sony's claim.

Whether the VHS group found the Sony system impossible or merely difficult is unclear at this stage. They may even claim to have come up with a better idea. The important thing is that what

The Betamovie has a side mounted TTL viewfinder with four LEDs to indicate the operating conditions. It uses a 12mm SMF Trinicon camera tube giving a minimum illumination rating of 28 lux. The lens is an F2, 6x power zoom (9mm-54mm) with macro capability. It features automatic white balance adjustment. Accessories include a shoulder strap for ease of carrying.

SONY BETAMOVIE DUE BY CHRISTMAS

Hopefully, before the end of the year, you will be able to buy this Sony BMC-100 "Betamovie" video camera, with its own in-built Beta format video recorder. There are no cables and no supplementary units to manhandle; you simply rest the body of the unit on your shoulder, steady it with the handgrip and press the button to start recording full colour pictures and sound.

In developing Betamovie, Sony have not waited for the new and much talked-about 8mm industry standard; nor have they generated a new standard of their own. They have designed Betamovie to accept an ordinary Beta format cassette and to impress on it a normal Beta format signal. After "exposure", the cassette can be removed, popped into an ordinary domestic Beta VCR, rewound and replayed immediately.

What is not ordinary is the ultra-compact in-built recorder mechanism. To the time of writing, Sony in Japan have not explained the configuration even to their overseas affiliates, and certainly not to the technical press. They have, however, said that the video head drum is about three-fifths the usual size, which would suggest a diameter of about 45mm and a rotational speed, for the same head writing speed, of 3000rpm for NTSC and 2500rpm for PAL. The drum is said to carry one only double-azimuth record head with an Omega type wrap for the tape.

This scant information is enough to cause much head-scratching in an effort to work out how they manage to record successive fields, with the requisite small overlap, with a single head. Simultaneous analog audio recording would seem to rule out anything but smooth, continuous tape travel. If the writer had to "take a punt" – and that's what it is – it would be to suggest that Sony are using the twin azimuth head to lay down two fields at a time from a single camera scan, discarding the information in between. In the PAL system, this would be equivalent to producting an ostensibly normal 625-line interlaced picture from 312 (plus overlap) lines of information.

Fairly obviously, because of lack of space in the camera body, Sony have not been able to provide the facilities normally expected in a VCR. There is no rewind or fast forward, cue or review, playback, or opportunity for editing of any kind. The Betamovie is strictly a record-only unit but it does offer more than three hours of recording time on one cassette, subject to battery power being available. Normally, batteries are slipped into the handgrip but a belt type battery pack is planned which will offer up to four hours of running time. An AC adapter/battery charger will also be available. The camera operates from a 9.6V supply and has a rated power consumption of 9.5W, representing a drain of 1 amp.

Overall size, including all projecting parts is given as 125×220×375mm.

they now offer does the same job, thereby removing one more reason for any haste to take up video disk for the sake of better sound quality.

The VHS hifi stereo sound system calls for two extra heads on the video drum to handle the FM sound signal only. Present information is to the effect that the extra heads have an azimuth angle of 30°, which is well removed from that of the video heads at (respectively) plus and minus 6°.

According to a press release from National Panasonic Australia, the sound Record/Play heads are so positioned on the drum that the FM sound track is laid down first, being over-recorded immediately afterwards by signals from the video head(s) in the same sector of the drum. Fairly obviously, the recording field strength from the video heads would need to be carefully controlled to ensure adequate recording without actual erasure of the sound track.

HIFI SOUNDTRACK

That aside, the significant point is that, in developing their three-in-two head system, National were clearing the way, not just for full two-speed facilities, but for a separate-head hifi sound system as well. From now on, their top-of-the-line models can be expected to carry six heads on the drum performing the functions of 10 single heads (4+4+2).

The National NV-800, carrying this new technology was announced for the NTSC market in May. For good measure, it is equipped with a tuner having provision to receive off-air TV stereo sound, which can be recorded on the high fidelity sound track. The standard fixed head sound system is retained, however, in the interests of compatibility with existing tapes.

National Panasonic Australia say that the PAL version of the NV-800 will be available in Australia "later in the year". They also say that the fixed head audio system will have conventional stereo facilities but only for the sake of compatibility. The logical course will be to use the high fidelity system for on-the-spot recording and playback, even with mono source material.

From the photograph of the NV-800, it is quite obviously a close relative of the existing NV-777, which prompted our earlier remark that the NV-777 was notable, not only for its existing array of facilities, but for the way in which it foreshadows what should be coming off the production line for the PAL market by the end of the year.

What's more, one can be reasonably certain that National will not retain a monopoly on these features. With standards set and the technology established, other VHS manufacturers will not be far behind.

And, equally, software manufacturers, who have been adding hifi Beta tapes to their inventory in recent months, won't take too long to add hifi VHS also.

Video disk — particularly the laser disk — still has its own strengths, such as higher picture quality, instant access and wear-free playback but its rival for the consumer dollar has proved to be a very tough opponent — and getting tougher by the month!

Representing "The Shape of Things to Come", this new National NV-800 VCR offers the facilities found on their current top of the line NV-777, plus high fidelity sound stereo and, in the PAL model, the option of half-speed tape travel and up to eight hours playing time.

KONICA — a new name in audio & video cassettes

Konica, a name well known in photographic circles is to feature also on a new range of audio and video tapes to be released in Australia. The stated aim is to have the tapes available in major retail outlets by the end of the year "at a highly competitive price" and "offering genuine value for money in these cost conscious times".

As might be expected for such a well known brand name, Konica tapes have solid business backing: from the Konishiroku Ampex Co Ltd, based in Tokyo, Japan. Established in May, 1981, the Company is a joint venture between the Konishiroku Photo Industry Co Ltd and the Ampex Corporation of America, the pioneers of video tape recording. The manufacturing plant is in Nakadate, Yamanashi Pref, Japan.

In a handsomely illustrated brochure, four grades of audio cassette are illustrated, ranging from a general purpose low noise ferric tape to a metal particle coated tape. In more detail they are:

ML (red packaging): General purpose, low noise gamma ferric cassette, type I, for normal bias and 120μS equalisation. Competitively priced and available in ML 50, ML 60, ML 90 and ML 120.

GM-I (blue packaging); "Grand Master" type I cassette for normal bias and 120μS equalisation, but of premium quality. Available as: GM-I 50, GM-I 60, GM-I 90.

GM-II (gold packaging): Top quality type II oxide cassette for Cr02 bias and 70μS equalisation. Available as GM-II 50, GM-II 60 and GM-II 90.

METAL (white packaging): A type IV metal particle coated cassette for the highest possible order of cassette performance. Available as METAL -50, -60 and -90.

Video cassettes

In the area of video cassettes, Konica are using a predominantly black packaging, with the tape content displayed prominently in white figures and with a distinctive colour motif for further identification.

In the PAL/SECAM VHS range there are four options: E-60, E-90, E-120 and E-180, the figures in each case indicating record/replay time at standard speed. In the Beta range are three options, L-250, L-370 and L-500 offering

playing times of 60, 90 and 120 minutes respectively, also at standard speed.

Konica claim that the tapes, manufactured in Japan, are of the very highest quality, with special attention having been paid not just to initial results but to performance in the longer term. An accompanying curve suggests that the video output level diminishes gradually by just over 1dB at 100 playings, remaining substantially level thereafter to beyond 200 passes.

For further information on Konica audio and video cassettes, contact: Konishiroku Aust Pty Ltd, Suite 2405, Northpoint, 100 Miller St, North Sydney 2060. Phone (02) 922 6873 or 922 6500.

On A Good Wicket!

Well pleased with their involvement, last season, with the visiting English cricket team, Hagemeyer (Australasia) B.V. have reached agreement with Australian cricketing star Geoff Lawson to promote their products during the 1983/4 season. Hagemeyer distributes JVC audio/video equipment, pianos and organs.

Hans Went, Group Managing Director, says that JVC will have a major position on the new Sydney score board and will be well placed in other major cricket grounds. Geoff Lawson will be appearing in JVC TV commercials.

THE KENWOOD KVA-502 AUDIO-VIDEO AMPLIFIER

If you are planning, in the near future, to invest in a new audio amplifier — and you also have an interest in video — it would make good sense before you buy to have a look at the Kenwood KVA-502 Audio-Video Amplifier, which has recently been released in Australia.

The KVA-502 can do most of the things that most enthusiasts expect of a modern integrated audio amplifier but, in addition, it offers video facilities which, if provided separately, would involve extra modules, extra cabling and considerably more outlay. Our own attitude to the KVA-502, as we put it through its paces, changed from "just another piece of gear" to a helathy respect for those who had worked out the design!

They obviously had a clear objective in view and have turned it into a very tidy piece of hardware for the emerging audio/video enthusiast.

PAST EXPERIENCE

This should not be surprising, because Kenwood is a respected name in the audio field. Kenwood amplifiers were a familiar product in the early days of hifi-stereo but they seemed to get lost somewhere in a series of distribution shake-outs. Now, a whole new range of Kenwood audio equipment is being relaunched in this country by Trio-Kenwood (Australia) Pty Ltd, based in Lane Cove, NSW. The KVA-502 is part of that range and one that may well pose a challenge for other suppliers.

What does the KVA-502 look like and what does it do?

Physically, its frontal appearance is in keeping with its role – combining a row of control pads reminiscent of a VCR, and a row of control knobs that clearly belong to an audio system. It has a burnished aluminium panel and a metallic grey case, measuring overall 440(W) x 109(H) x 336(D)mm and weighs a modest 8.1kg. The dimensions and finish would allow it to group naturally with most modern hifi components and 430mm-wide VCRs.

Its central and basic role is undoubtedly that of a hifi-stereo integrated amplifier. As such, it has input provisions for a moving magnet phono cartridge, an AM/FM stereo tuner and an audio stereo tape deck. Inputs are by way of RCA type sockets, with an alternative DIN input/output socket for the tape deck.

It has provision to feed two sets of loudspeakers which can be used separately or simultaneously, providing the nett impedance presented to the amplifier does not fall below 4 ohms per channel. Loudspeaker switching is on the front panel, along with a socket for stereo headphones.

by NEVILLE WILLIAMS

Also on the front panel are normal amplifier facilities such as power on/off switch and indicator, input selectors for tape/tuner/phono, a prominently featured volume control, bass control, treble control, stereo balance, loudness switch for low level listening, and a muting switch which will drop the sound by 20dB without having to touch the volume control.

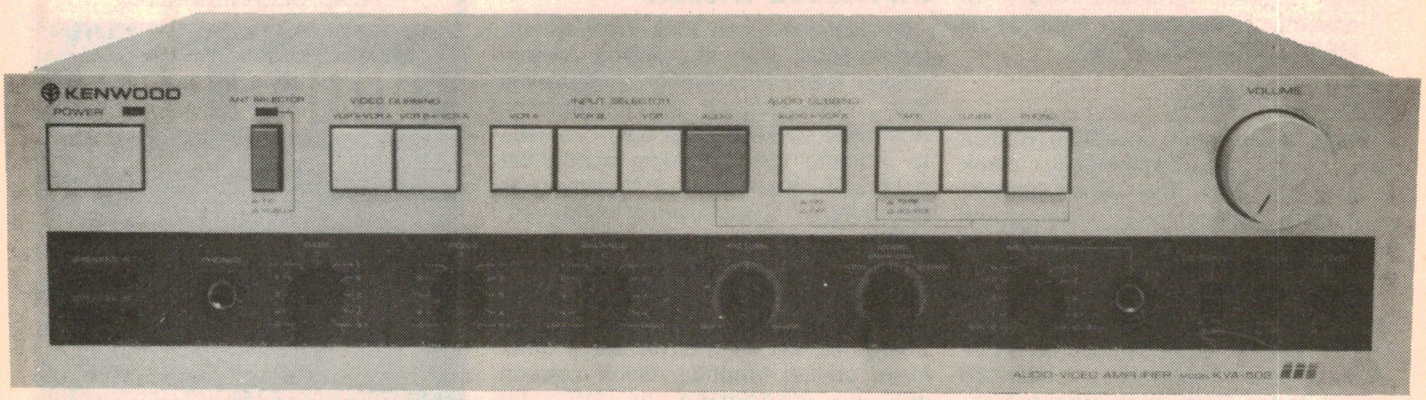
In addition to these expected facilities, the KVA-502P provides a 3-position "Mode" switch. When set to the "Mono" position, it blends incoming stereo signals into mono, which is then fed to all channels; from the loudspeaker systems it provides a virtual centre image and, from the stereo phones, an image in the centre of the listener's head.

SIMULATED STEREO

While this has its uses on occasions, the centre "Enhance" position of the Mode switch is more interesting: it synthesises a stereo signal from a mono source as, for example, from an AM radio station or the soundtrack of a standard VCR. It provides a very convincing stereo effect, indeed.

In the third ("Stereo") position of the Mode switch, stereo is passed through unchanged.

The KVA-502 also has provision on the front panel for a mono microphone and mic level control which will allow the user to make a voice recording or to sing-along with sound from any external source. As an interesting touch, Kenwood have provided deliberate interaction between the mic level and volume



Despite the facilities it offers, the KVA-502 is no larger than an ordinary hifi integrated amplifier.

controls such that, as the mic level is advanced, the main signal level is diminished to provide a smooth, single-knob fader/mixer.

While the KVA-502 does provide these extra features as a by-product of its yet-to-be-discussed video role, it has also sacrificed some facilities commonly found in normal integrated amplifiers. How they rate will depend on the individual:

- There is no direct provision for a moving coil magnetic phono cartridge. As with most existing amplifiers, an external pre-preamplifier or a step-up transformer would normally be necessary in the event of such a cartridge being selected.
- Direct audio inputs are provided only for tape, tuner and phono. Most integrated amplifiers have at least one "AUX" (or spare) input. Without this, the user would either have to change over audio plugs or perhaps press into service a video sound inlet to cope with an extra audio source.
- There is direct provision to connect only one audio tape deck, considerably complicating the task of audio dubbing, if the need should arise.
- There are no high- and low-frequency filters – admittedly not a very serious omission.
- There are no output level meters or bargraph indicators – something buyers tend to look for, these days.

In terms of audio performance, the KVA-502 aligns pretty well with its published specifications.

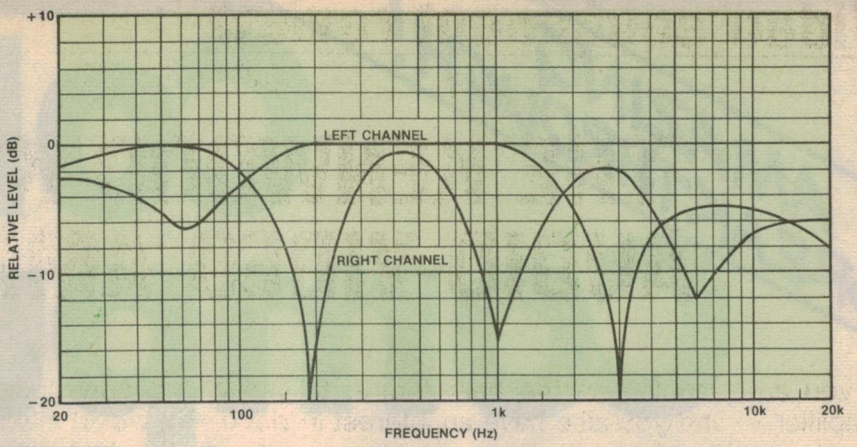
For continuous average power output, Kenwood claim: "55 watts per channel minimum RMS, both channels driven, at 8 ohms from 20Hz to 20kHz with no more than 0.05% total harmonic distortion" – this on the basis of FTC testing for the USA.

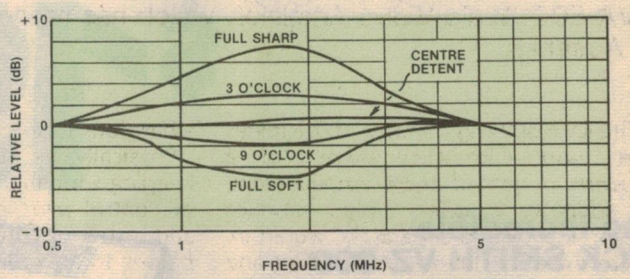
TEST RESULTS

Tested at 20Hz, 1kHz and 20kHz, the unit supplied to us met the above specification, with something to spare in the middle register: 60W RMS per channel into 8 ohms, both channels driven, with a total harmonic distortion level of 0.045%.

At the 1W level, THD was measured at 0.035% from 20Hz to 20kHz.

Kenwood claim a clipping power of 70W into 8 ohms, although curves in the accompanying publicity suggest that this would apply only to the middle frequencies. They also claim a headroom of 3dB under dynamic conditions (pulsed or program signal) and a dynamic power output of up to 95W. We did not seek to explore these claims, although there was evidence of plenty of headroom in the fact that a single-channel test yielded 70W RMS at 0.025% distortion.

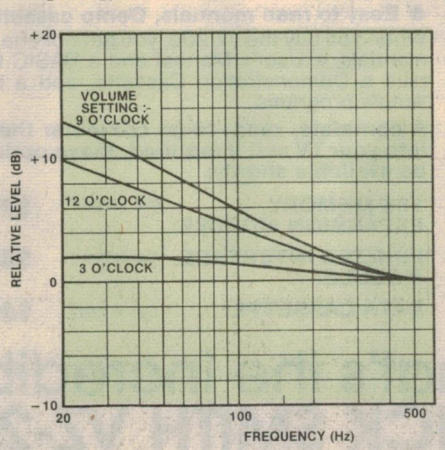




Two forms of signal enhancement: above, the response through the audio stereo simulator. At right, the response at different settings of the video "Picture" control potentiometer.

A frequency response measurement of the main amplifier yielded figures of −0.5dB at 10Hz and −3.0dB at 60kHz, compared with a specification of 8Hz to 80kHz for −3.0dB. Frequency response from the phono input, taking in the RIAA compensation, gave an excellent result: within 0.5dB overall from 20Hz to 20kHz.

Phono input sensitivity was 1.0mV for full output (2.5mV rated) and 170mV (150mV rated) for the tuner and tape channels. Signal/noise ratio, adjusted for 2.5mV phono input and 60W output, came out at 73dB unweighted (81dB rated, A-weighting); for tuner and tape, 70dB unweighted (100dB rated, A-weighting).



The Loudness switch has its greatest effect at low level settings of the volume control. The amount of bass boost diminishes as the volume is advanced.

Bass and treble tone controls, rated at ±10dB, gave figures of +12dB and −11dB at 100Hz; and of +10.5dB and −10dB at 10kHz. The muting switch dropped the level by exactly 20dB.

In an effort to forestall misuse, the Loudness switch is interconnected to the volume control, making the switch most effective for low volume settings. Beginning at about 400Hz, the Loudness switch gradually boosts the bass to about +13dB at 20Hz, with the volume control in the 9-o'clock position. In the 12-o'clock position, the boost is +10dB, diminishing to about +3dB in the 3-o'clock position.

CONVINCING EFFECT

Last but not least comes the stereo enhance function – the centre position of the Mode switch. As shown in the accompanying graph, the right-hand channel shows a fairly coarse comb filter shape with troughs at 190Hz, 1kHz and 6kHz. Curiously, however, the left-hand channel complements this characteristic with troughs at 60Hz and 3kHz but not at 500Hz; the region between 200 and 1000Hz is flat. Perhaps the intention is to favour a centre image for the human voice.

Whatever the case, the enhance function is very effective in dispelling the "point source" effect of ordinary mono sound, even when heard through a two-channel system.

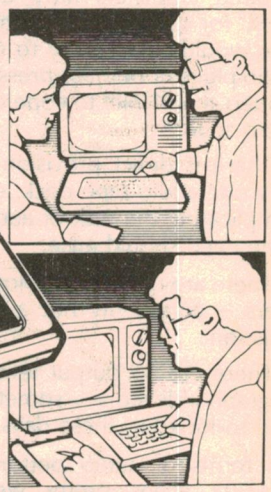
So much, then, for the KVA-502 in its basic role as an integrated hifi audio amplifier. What does it have to offer in the way of video facilities?

AMAZING BREAKTHROUGH!

Colour Computer

$199

Now every family can afford their own personal computer!



The incredible DICK SMITH VZ 200 Personal Colour Computer

Here it is at last - the breakthrough you've been waiting for! A personal colour computer with all the right features: colour graphics, sound, standard Microsoft BASIC for easy programming, a whopping 8K bytes of RAM memory, the ability to work with a standard TV set, and much more. Yet thanks to modern electronics and our buying power, the Dick Smith VZ-200 will cost you only $199 - far less than any comparable computer! There'll never be a better time to invest in your family's future.

Yes, for just $199, the Dick Smith VZ-200 gives you amazing computing power - far more than many machines two, three, or even four times the price. Now you can find out what computers are all about. The kids can use it with their school work. It can keep track of your home budget. It can even help you in your business!

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READ WHAT THE EXPERTS SAY:
'Overall, this is a great little computer, and one that is likely to change the face of Australian personal computing'.
And from the editor:
'I'm certainly going to buy one'.
(May 1983 issue, Australian Personal Computer)

Cat X-7200

- **Simple and safe to use**
Operates from low voltage via a mains adaptor, which is included in the price. Absolutely safe - even for children.
- **Works with any normal TV set**
It simply plugs in, no need to buy an expensive monitor (unless you prefer to use one!).
- **Uses a normal cassette recorder**
No need to buy a high cost computer type recorder.
- **Easy to read manuals, Demo cassette.**
When you buy the VZ 200, you get not one but two manuals, a User's Manual and a BASIC Manual, plus a Demonstration Cassette, and a book of simple programs.

A complete, ready-to-go computer that plugs into your TV set! If required, these options will be available shortly:

16K MEMORY EXPANSION MODULE:	Cat X-7205	**$79.00**
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To get your computer up and running.

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That's the incredible DICK SMITH VZ-200

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See Page 98 for full address details.

A555/CT

KENWOOD KVA-502 — continued

Provision is made to connect to the KVA-502P a TV antenna, a normal colour TV receiver with RF (antenna) input, a colour TV monitor with video input, two VCRs and a video disc player. (Presumably, the video disc access could be used for other compatible video/sound sources, directly or via an external video mixer).

All these connections are made on the rear panel, with Belling Lee connectors for the RF input and output but RCA sockets for the rest. Allowing for the audio connections as well, it adds up to a very complicated rear panel, indeed.

Fairly obviously, one would not want to be connecting and disconnecting all those cables too frequently, nor would it be very practical to do so in the confined space of enclosed shelves. The KVA-502 would clearly be most practical mounted, along with all the other units, in an equipment rack on castors or otherwise accessible from the rear.

VIDEO ROLES

In its least functional role, the KVA-502 can simply route the TV antenna through to the TV receiver. This happens automatically when the unit is switched off or when the Antenna Selector pad is latched to the "TV" position. Appropriately, with the TV antenna fed straight through, other functions of the KVA-502 are accessible for independent use.

Prominent among these facilities is the provision for video dubbing (a procedure which may involve prior consideration of copyright).

Two VCRs can be connected permanently to the KVA-502 but only one of them — designated as VCR-A — is provided with input signals for dubbing purposes. It can receive video and audio signals from VCR-B, or from the video disc player. Audio dubbing is also possible on to the soundtrack of VCR-A from any audio source: tuner, audio tape, phono or microphone. It therefore provides facilities for adding voice-plus-music commentary to video home-movie or travel tapes.

In addition, the tuner option makes it easy to cope with the occasional simulcast, involving video from a TV station and stereo sound from a separate FM radio channel.

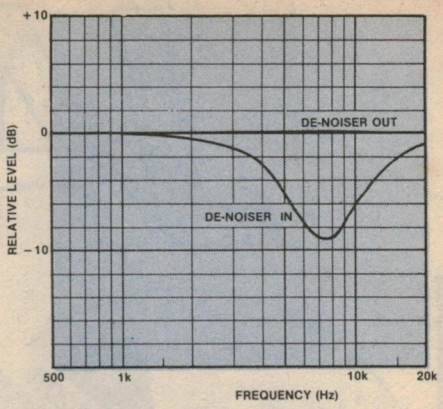
When signals are passing through the internal video circuitry of the KVA-502, they are subject to a "Picture" control with extreme settings marked "Soft" and "Sharp". Controls like this are now appearing on VCRs, as well as on add-on video enhancers. Their visual effect is not very uniform however, with some of them appearing rather too prone to produce sync pulse overshoot, thereby affecting synchronisation almost as much as they do the picture!

We have no such complaint against the circuitry in the KVA-502. There is little suggestion or picture pulling and the control is unambiguous in its visual effect. The user can observe the sharpened outlines and select a position just short of the haloes produced by video ringing.

Measurement showed that the control has most effect around 2MHz, with a maximum boost of just over 7dB and a maximum cut of about 4.5dB. With the control in the detent position, response throughout the video circuitry is virtually flat to 5MHz with a bump of less than 1dB in the 2 to 4MHz region. Beyond 5MHz, it rolls off sharply.

When dubbing from VCR to VCR, the "De-Noiser" switch is available to assist with a notably noisy soundtrack. It brings in a dynamic system which has very little effect when the signal level in the upper register is high, the assumption being that it will mask the noise anyway. When the signal level falls, however, the response in the region 7 to 8kHz falls by about 9dB, producing a noticeable subjective improvement in the signal/noise ratio.

In addition to the antenna switching, mentioned earlier, the KVA-502 provides two output feeds to TV receiver/monitors. One is a direct video feed for a monitor, the other via an inbuilt modulator, produces an RF Output signal on UHF. It appears to be an excellent modulator, with no suggestion of picture pulling which can result from indiscreet video peaking.



When the de-noiser is switched in, it can reduce the audio response around 7-8kHz by about 9dB in the absence of high frequency signal to mask tape hiss.

By using one VCR as a tuner and passing the signal through the KVA-502 to either a TV receiver or a monitor, the image can be touched up with the Picture control for best visual impact, while the sound can be "enhanced" into simulated stereo and fed through to the hifi loudspeakers. Or, if space is no object, it could be switched through to smaller units arranged on either side of the TV screen.

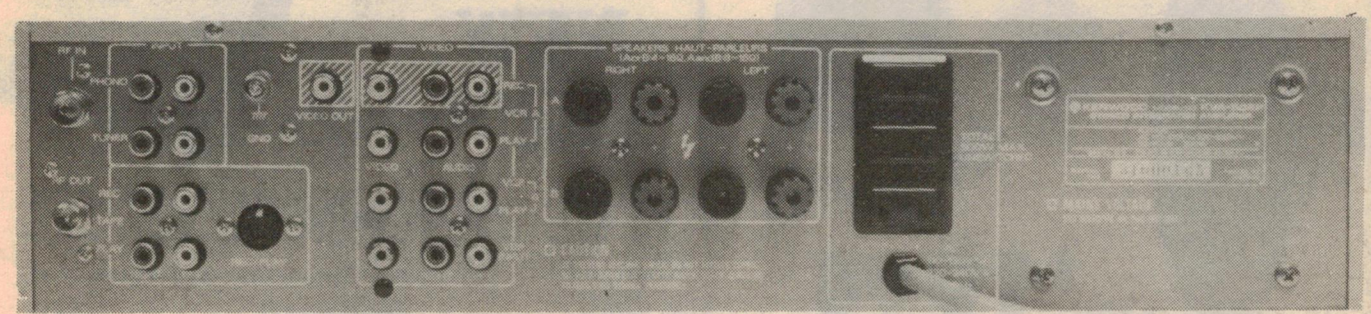
There may well be other tricks that one can pull with the KVA-502 but, by now, you will have gained a fair idea of what it's all about.

HOW TO DRIVE IT?

How does one cope with all the switching options? That has to be admitted as a problem. Kenwood have done their best to rationalise the operation but it would take little short of a genius to memorise the contents of the user instruction manual at one sitting.

And most family members will best be encouraged to press that this and that and forget the rest until Dad gets home!

As we said at the outset, experience with the KVA-502 left us with a healthy respect for those who had worked out the design. Recommended retail price is $659. For further information, contact Trio-Kenwood (Australia) Pty Ltd, 4E Woodcock Place, Lane Cove, NSW 2066. Telephone (02) 428 1455.



On the rear panel, the audio connections are at the left, then the video connections, with speaker terminals in the centre.

JAYCAR

Tape Sensation!

NEW Amazing only **$19.95**

2500′ – 1.5 mil
Cat. AL-1560

3600′ – 1.0 mil
Cat. AL-1561

Jaycar has done it again – for all of the Hi Fi buffs who have professional NAB centre reel-to-reel tape recorders – a superb METAL spool complete with either 2500′ or 3600′ of quality tape. Both tapes are priced the same, the only difference between tape lengths is the thickness of the tape itself. The 3600′ tape is 1.0 mil thick and the 2500′ tape is 1.5 mil thick. You make your choice from these two superb bargains.
The spool size is 10¾″

¼″ TAPE

'Power UP'

POST STOCKTAKE SPECIAL

Ref: EA 11/82

~~$39.50~~
SAVE $5.00
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NO ROOM FOR DETAILS

NEW spray on conductive plastic $6.95

This handy 200 gram spray enables you to do all manner of things. You can spray sheets of Styrene foam and make them suitable for storing your MOS IC's. Far cheaper than other methods!! You can make conducting screens inside plastic boxes to shield RF. You can re-coat the back of CRTs. You can make conductive parts of equipment cabinets to help reduce static.
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Grab a can now. You never know when you will need it!
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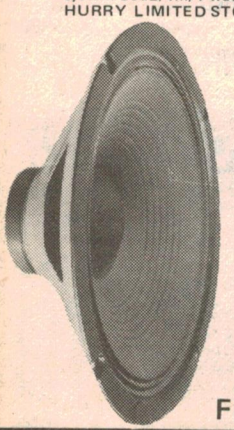
3–WAY SYSTEM $24.95 a set

That's right a 3 – WAY HI FI speaker kit from only $19.98!!
Each kit contains a massive 10″ (250mm) woofer, cone midrange and DOME tweeter!! You also get, at no extra charge, the special cross-over capacitors!
The system is rated at approximately 20 watts RMS so it is ideal as an economical but reasonably powerful main Hi Fi unit or as a second system for another room or outdoors.
Each 3-way kit comes with a recommended enclosure design which you can build yourself easily!
You would normally pay well over $60 for the equivalent from major kit speaker suppliers so this is an outstanding bargain. Sensitivity of system 93dB/1m/1 watt. Cat. AK3700
HURRY LIMITED STOCKS and they are made in JAPAN!!



Woofer not to same scale as other components

FROM **$19.98**

minitune

Specification

Function		F.S.D.	Resolution	Accuracy
Voltage (d.c.)		2.0V	1.0mV	0.5% ± 1 digit
		200V	100mV	0.5% ± 1 digit
Resistance		200Ω	100mΩ	0.5% ± 1 digit
		20kΩ	10Ω	0.5% ± 1 digit
R.P.M.		20,000r.p.m.	10r.p.m.	1% ± 3 digits
Dwell		90°	0.1°	2% ± 3 digits

FAR CHEAPER THAN DPM SEPARATELY

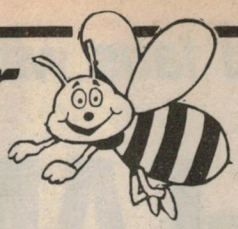
NEW

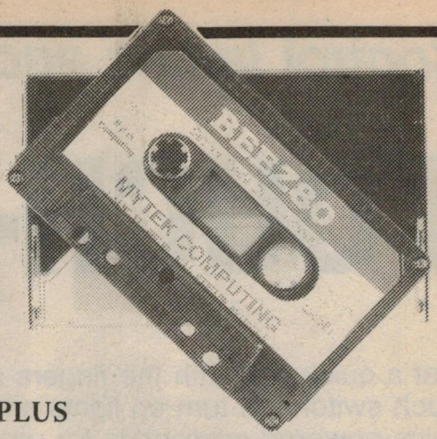
$42.95

Ref: EA June 1983

Following the spectacular success of the DP2010 Digital Multimeter kit, we now have an ENGINE ANALYSER KIT!
But the spectacular thing is the price! It is ACTUALLY CHEAPER than the DPM-05 Display and Case!!
The Minitune will measure voltage, resistance (down to a very low range), RPM and Dwell Angle.
Cat. KJ7012 MINITUNE KIT $42.95
TEST LEADS TO SUIT ONLY $2.95

Software for your MicroBee →→→





Jaycar is proud to announce the first of a range of Computer Software for the Australian - made "MicroBee" Computer. Like the MicroBee, the software is made in Australia and is of outstanding quality. Our initial range consists of six of the most professional items that we have seen.
All programs come in a plastic wallet with comprehensive instructions. The program is recorded on a high quality cassette.

BEEZ80
SECRET CODE DISASSEMBLER

BEEZ80 will disassemble ANY code sequence. Nothing is illegal! It will allow you to program with codes that no other disassembler can decipher!

$19.95

Cat. YS-4022

BASIC TUTORIAL
Let your MicroBee Teach You MicroWorld BASIC

Super teaching aid for the classroom. Excellent for both young and old, regardless of background

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Learn to touch type in hours Cat. YS-4021 $19.95

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Let Your MicroBee Teach You Machine Code Programming and All About Itself $24.95

Cat. YS-4023

Unrivalled versatility

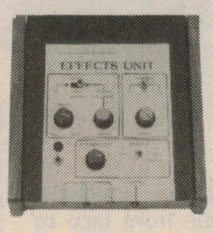
TRANSISTOR ASSISTED IGNITION

Ref: EA Jan '83. Latest version of this popular kit. The Jaycar kit has a genuine die cast box - as used in the EA prototype. Beware of others that use flimsy sheet metal.

Cat. KA1506 $35

magnificent!

BBD EFFECTS BOX



Fantastic low-cost instrument using the versatile MN3001 Bucket-Brigade Delay line to achieve brilliant sonic effects.
Now you can emulate the commercial rock groups with Phasing, Flanging, Reverb and Echo. The Jaycar kit includes all components INCLUDING IC sockets and the TU-04 box. (Not cut down but this is easily done).
Jaycar has a specially built cabinet for this kit with all holes pre-punched etc., at only $10 extra but only if you buy the original kit from us. Available as a separate item for $29.50.
WHEN THE KIT IS PURCHASED WITH THE DE-LUXE CASE THE TU-04 CASE WILL NOT BE SUPPLIED.

COMPLETE KIT
Cat. KE1522
$79.00
Special cabinet to suit $10.00
Cat. HB6445

MICRON 30 WATT
SOLDERING IRON

Cat. TS-1450 $9.95

LIGHT WEIGHT – SCREW IN INTERCHANGEABLE TIPS – EFFICIENT THERMAL TRANSFER FROM ELEMENT TO TIP – TIP TEMPERATURE MAINTAINS WITHIN THE LIMITS SUITABLE FOR ELECTRONIC WORK AND ALSO SMALL HOUSEHOLD JOBS – FULLY S.E.C. TESTED & APPROVED

LOW COST DIGITAL MULTIMETER KIT

ONLY $45

Ref: EA March 1983 (This month)
Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it considering the fine low-cost built-up units available. The DP2010 changed all that.
This kit, fully imported from the UK uses the famous DPM-05 custom LCD/Voltmeter to achieve phenomenal accuracy at very modest cost!
All parts are included to complete the meter including an attractive and colourful front panel.
(a 9V battery is required)

Set of test probes to suit $2.95
Probe to suit Cat. WT5312 ONLY $2.50
Eveready 216 (red) 9V Battery Cat. SB2370 ONLY $1.40

DP2010 kit Cat. KJ7010
ONLY $45

SPECIFICATIONS

Function	f.s.d.	Resolution	Accuracy	Protection
Volts (d.c.)	2V	1mV	1%±1 digit	500V for
	20V	10mV	1%±1 digit	one minute
	200V	100mV	1%±1 digit	
	500V	1V	1%±1 digit	
Current (d.c.)	2mA	1uA	1%±1 digit	1A/250V
	20mA	10uA	1%±1 digit	
	200mA	100uA	3%±1 digit	
	2000mA	1mA	5%±1 digit	
Volts (a.c.)	2V	1mV	2%±5 digit	500V for
	20V	10mV	2%±5 digit	one minute
	200V	100mV	2%±5 digit	
	500V	1V	2%±5 digit	
Current (a.c.)	2mA	1uA	2%±5 digit	1A/250V
	20mA	10uA	2%±5 digit	
	200mA	100uA	4%±5 digit	
	2000mA	1mA	7%±5 digit	
Resistance	2K	1	1%±1 digit	260V
	20K	10	1%±1 digit	r.m.s.
	200K	100	1%±1 digit	
	2000K	1K	1%±1 digit	
Diode Test	2V	1mV	1%±1 digit	260V r.m.s.

AC VOLTAGE AND CURRENT RANGES
When S3a selects a.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. component.

CannonXL connectors - great new range ✱ ✱ ✱

5 PIN AND RIGHT ANGLE TYPES ARE NOW IN STOCK

PP2120 – 3pin male line	$3.50
PS4020 – 3pin female line	$3.95
PP2112 – 3pin male chassis	$3.25
PS4012 – 3pin female chassis	$3.95
PP2117 – 5pin male line	$6.95
PS4026 – 5pin female line	$7.95
PP2116 – 5pin male chassis	$5.95
PS4016 – 5pin female chassis	$6.95
PS4010 – 240V mains line	$6.50
PP2110 – 240V mains chassis	$5.25
PP2113 – 3pin male r/angle	$4.95
PP4030 – 3pin female r/angle	$5.95

0–30V 1amp power supply
ETI 162 Ref: ETI December 1982

Cat. KE4570

$49.50

- Fully protected
- Output variable from 0-30V DC
- Selectable current limit
- Both voltage and current metering
- After a multimeter & soldering iron an absolute must for the enthusiast.

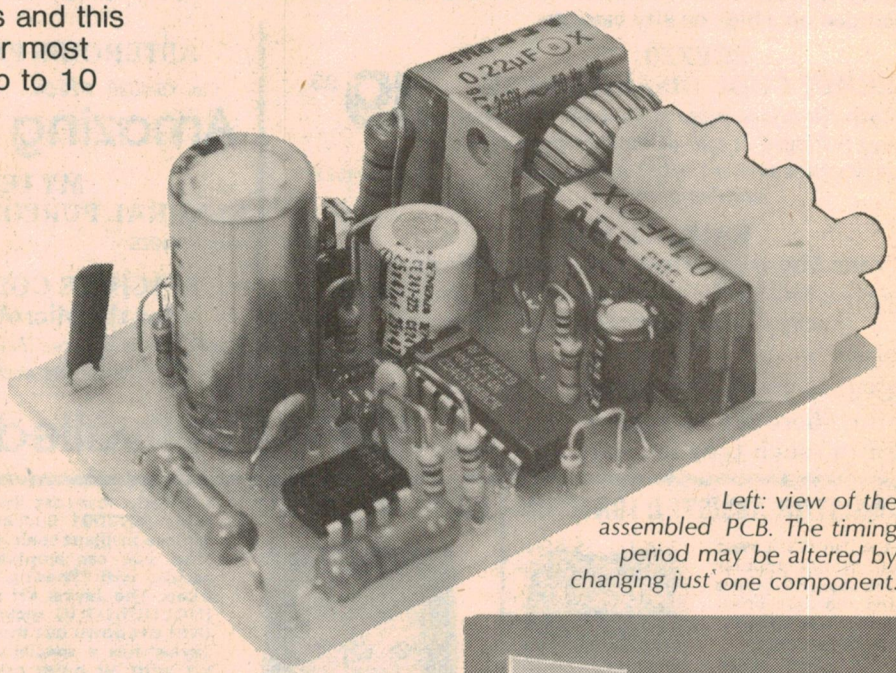
You will never own a more useful piece of gear.

Control lamps and fans with the

TOUCH-LAMP TIMER

Just a quick dab with the fingers and this touch switch will turn on lights or most mains-powered appliances for up to 10 minutes.

by COLIN DAWSON



Left: view of the assembled PCB. The timing period may be altered by changing just one component.

If you have ever tried to operate one of the mechanical type delay switches with your hands full, you'll realise just how tricky this can be. The usual method is to make desperate stabs at the button with your elbow and hope for the best. This usually only succeeds in partially depressing the button, leaving you stranded half way up the stairs when the light goes out.

Once activated, this timer will remain on for the full duration of its delay – every time. Stairwell lighting is not the only possibility for the timer – it may also be used with lights in the hallway, garage or porch. It would be most suitable for use in those situations where there is more than one existing light. One could be switched in the normal way for long term use and the timer could be used for when you're "just passing through".

When this project was first conceived, our primary objective was to come up with a design that could function as a direct replacement for any normal mains switch. This meant a "two wire" device – one connection to the mains active and one to the load. We considered that it would be unacceptable for the circuit to require its own neutral connection as this would, in many cases, necessitate extra wiring.

As it happens, our Touch-lamp Dimmer (April '83) is such a device, requiring only one connection to the active line and another to the load. By making a few modifications, we were able to change the circuit from a touch-activated dimmer to a touch-activated timer.

In fact, out new Touch-lamp Timer closely resembles the Touch-lamp Dimmer, both in circuit configuration and appearance. Like the Touch-lamp Dimmer, it is built on a small printed circuit board which is mounted on the back of a blank grid plate from the HPM Decorator range. This has the standard mounting holes of normal switch plates. A metallic panel is clipped over the front face to form the touch plate.

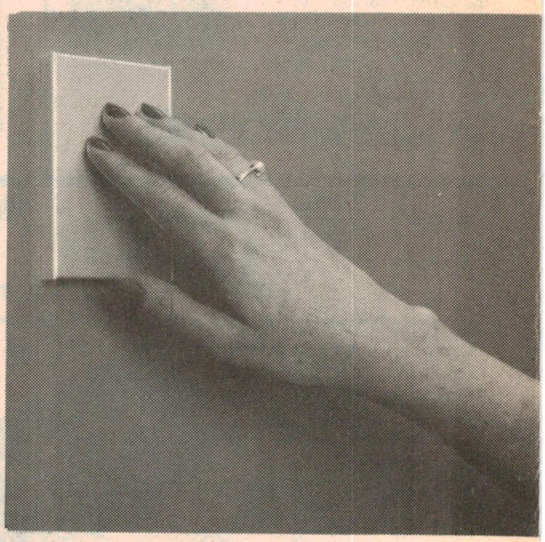
The touch plate is available in a variety of finishes. We chose gold-finished aluminium for our touch plate but you can also choose from satin silver aluminium, stainless steel and brass.

With some minor component changes to the timer, it can also be used to run a fan instead of a lamp. This makes it suitable for use with exhaust fans, such as those used in bathrooms. The fan would operate for the predetermined period and then switch off automatically.

If the Touch-lamp Timer is used for a stairwell or porch light timer, it may need to be operated from several different locations. To this end, we have made the circuit compatible with the remote extension of the Touch Lamp Dimmer. This relatively simple and inexpensive circuit is already available in kit form and could conveniently be added to the timer.

In common with light dimmer and fan speed controller circuits, the timer employs a Triac to interrupt the supply to the load. The Triac, a device capable of switching both positive and negative mains half cycles, is triggered by a low voltage pulse of either polarity applied between its gate and terminal one. Once triggered, it continues to conduct between terminals one and two until the mains voltage waveform crosses zero.

By triggering the Triac early in each mains half cycle, virtually the full mains voltage is applied to the load and it functions normally. Triggering the Triac later in each half cycle will cause a progressively lower average voltage to be applied to the load. This results in the familiar dimming effect for lamps and



A quick touch with the fingers turns on the lights for up to 10 minutes.

reduced speed for a fan, although this function is not employed in this circuit.

The delay between the zero voltage crossing and firing the Triac is referred to as the phase angle. If the Triac were to be fired instantly at the zero crossing, the phase angle would be 0° and if it were not fired at all, the phase angle would be 180°. In this circuit, the Triac is controlled by an S576A light dimmer IC and is operated such that the minimum phase angle is 35°. Although a lamp will appear to be operating at very nearly full brightness, it will always have slightly less than the full mains cycle applied to it.

During the first 35° (or 2ms) of each mains cycle the lamp does not have any voltage applied to it. Instead, the full mains voltage appears across the Triac circuit. Charge pump circuitry enables the voltage present during this 2ms period to power the timer for the remainder of the mains cycle and this allows the circuit to operate without a separate neutral connection.

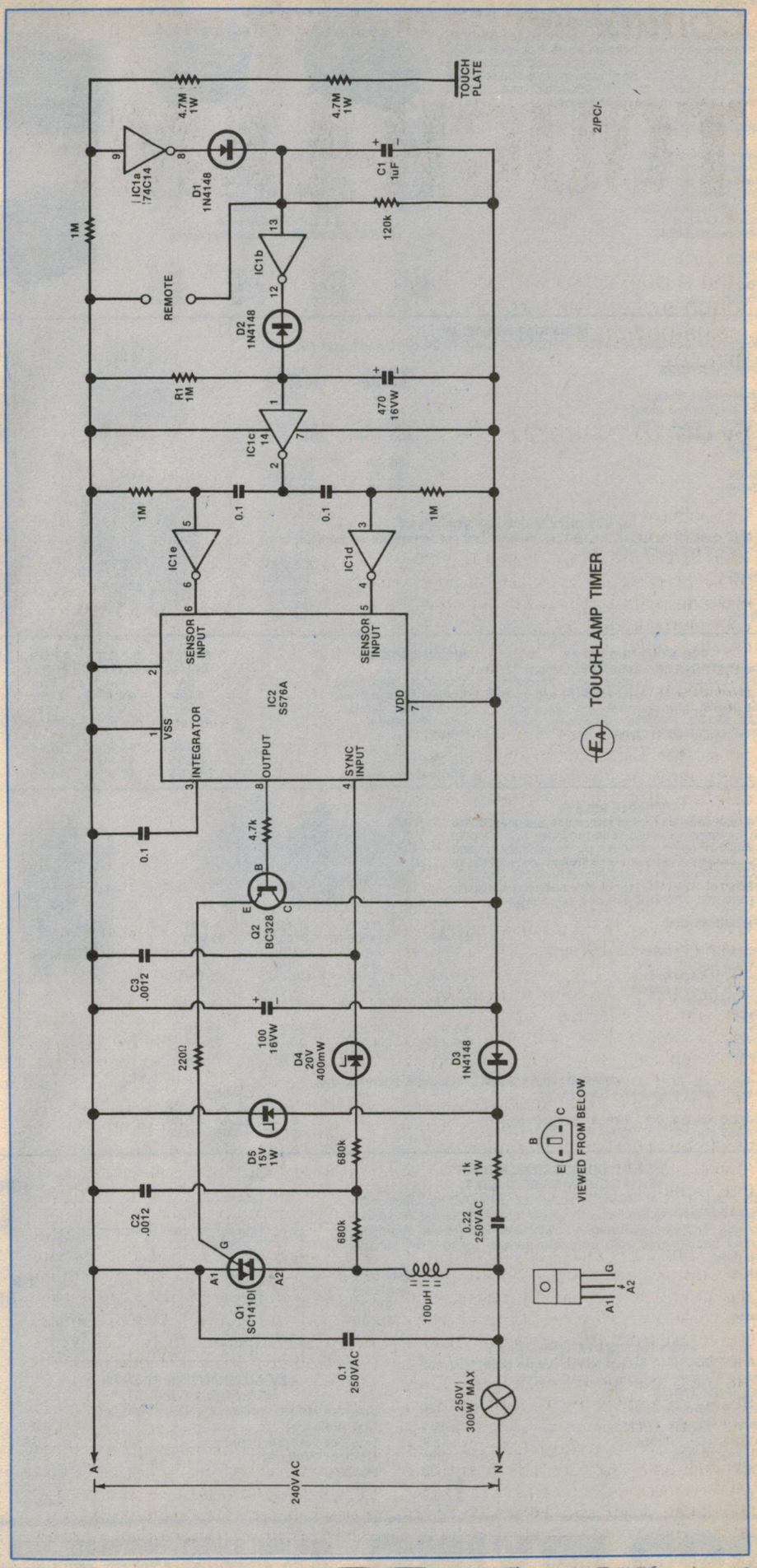
The lamp is switched off when the S576A stops supplying trigger pulses to the Triac. Normally, the input of this IC is connected to the touch plate and the duration of the touch determines the mode of operation. Any input signal of less than 50ms is regarded as spurious and is ignored. A signal of between 50 and 400ms causes the IC to operate in the on/off mode and signals of longer than 400ms initiate the dimming mode. Since we are not utilising the dimmer function, all input signals are conditioned such that they are about 100ms in duration so that the IC operates only in the on/off mode.

The circuit incorporates a toroidal inductance which provides effective suppression of radio interference from the circuit. This is particularly important because the rapid switching of the Triac can generate an unacceptable level of electromagnetic interference.

How it works

Operation of the circuit is actually quite straightforward if we consider it as a chain of events controlled by the touch plate. When somebody touches it, the touch plate supplies a signal which is processed by a series of inverter stages. This enables a 100ms pulse to be presented to the S576A at the beginning of each time period and another at the finish. Trigger pulses from the S576A are supplied to the Triac via a transistor buffer (Q2) and are timed such that the Triac operates with a 35° phase angle.

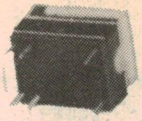
The main functional blocks of the S576A's internal circuitry are a phase locked loop, and ignition angle limiter and signal conditioning/evaluation. We have already discussed the operation of the signal evaluation section, ie, determining the required mode of operation.

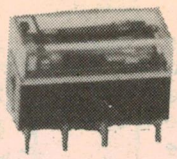


RELAYS

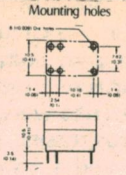
DUEL INLINE RELAYS

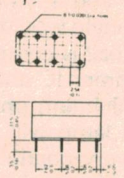
Either plug into an IC socket or solder directly into PCB. These are an off the shelf item we have all been waiting for 5V and 12V DC coil voltages. Gold contacts and carry 1A at 24VDC 2.54mm spacing to fit Matrix Board, Vero DIL Boards or PROTOBOARDS max. current rating 110VAC at 0.5 (resistive load).





Mounting holes

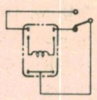




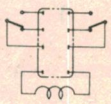
Mounting holes

Terminal arrangement

(Bottom view)



S.P.D.T.
S14100
S14104



D.P.D.T.
S14102
S14106

UNIT: mm (inch)

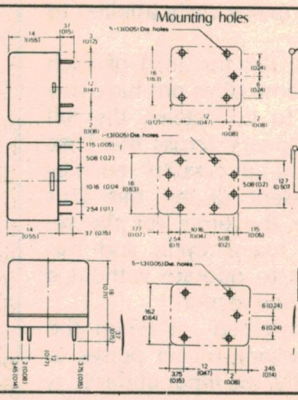
Terminal arrangement

SPECIFICATIONS	S.P.D.T. S14100	D.P.D.T. S14102	S.P.D.T. S14104	D.P.D.T. S14106
Nominal Coil Voltage	5V	5V	12V	12V
Contact Current (max)	1A	1A	1A	1A
Contact Voltage (max)	125VAC	60VAC	125VAC	60VAC
Coil Resistance	70 ohm	320 ohm	52 ohm	280 ohm
Operative Time (max)	5ms	8ms	5ms	8ms
Service Life (mech)	1 x 10^7 operations min			
Service Life (elec)	1 x 10^5 operations min (at contact rating)			
PRICE				
1-9	$2.95	$4.75	$2.95	$4.75
10-24	$2.45	$3.95	$2.45	$3.95
25-99	$1.95	$3.25	$1.95	$3.25

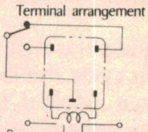
MINIATURE PCB RELAY

Massive 3A contacts at 24VDC or 100VAC nominal 12V coil but will work OK from 9-15V.

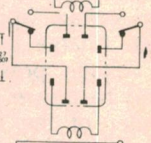
Mounting holes



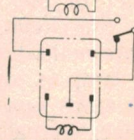
Terminal arrangement



S.P.D.T.
S14060



D.P.D.T.
S14061



S.P.D.T.
S14066

5 AMP Contacts

SPECIFICATIONS	S.P.D.T. S14060	D.P.D.T. S14061
Nominal Coil Voltage	12V	12V
Contact Current (max)	3A	3A
Contact Voltage (max)	125VAC	60VAC
Coil Resistance	400 ohm	300 ohm
PRICE		
1-9	$2.00	$2.75
10-24	$1.50	$2.00
25-99	$1.20	$1.75

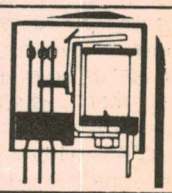
HEAVY DUTY MINIATURE PCB RELAY

5 AMP contacts at 24VDC or 100VAC nominal 12V coil voltage but will work OK from 9-15V coil resistance 400 ohm.

PRICE	S.P.D.T. S14066
1-9	$2.95
10-24	$2.25
25-99	$1.95

PCB MOUNTING RELAY

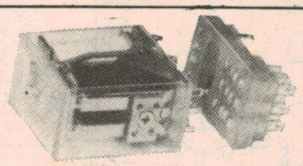
The most popular relay used in E.A. and E.T.I. kits. Extremely versatile and compact 240VAC 6A relay. Ideal for PCB mounting with plastic dustproof case and heavy duty gold flashed contacts. (Previously called "PYE" or "FUJISTA" type.)

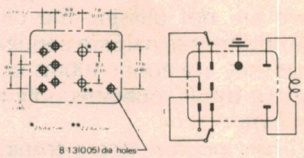


SPECIFICATIONS	S.P.D.T. S14110	D.P.D.T. S14112	S.P.D.T. S14114	D.P.D.T. S14116	S.P.D.T. S14118	D.P.D.T. S14120
Contact Current (max)	6A	6A	6A	6A	6A	6A
Contact Voltage (max)	240V	240V	240V	240V	240V	240V
Nominal Coil Voltage	6V	6V	12V	12V	24V	24V
Coil Resistance	45 ohm	50 ohm	180 ohm	200 ohm	720 ohm	720 ohm
PRICE						
1-9	$7.95	$8.95	$6.95	$7.95	$7.95	$8.95
10-24	$6.95	$7.95	$6.25	$6.95	$6.95	$7.95
25-99	$5.95	$6.95	$5.50	$5.95	$5.95	$6.95

CRADLE RELAYS

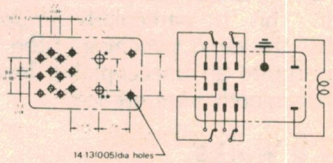
The most common type of relay made and used. There are hundreds of applications for these multiple pole changeover relays where low power consumption and high reliability is required. Gold flashed contacts and insulation resistance of 100M ohm at 500VDC. Dielectric strength of 1000VAC (1 min) operation time is typically 6-15ms (max) Release time of 4-10ms (max).





8.13(005)dia holes

D.P.D.T. **S14070** **S14068**



14.13(005)dia holes

4 PDT **S14070** **S14071**

SPECIFICATIONS	D.P.D.T. S12067	D.P.D.T. S14068	4 PDT S14070	4 PDT S14071
Nominal Coil Voltage	12V	24V	12V	24V
Contact Current (max)	2A	2A	2A	2A
Contact Voltage (max)	125VAC	125VAC	125VAC	125VAC
Contact Power (max)	120VA	120VA	60VA	60VA
Coil Resistance	325 ohm	1600 ohm	185 ohm	700 ohm
PRICE				
1-9	$5.95	$5.95	$6.95	$6.95
10-24	$4.95	$4.95	$5.95	$5.95
25-99	$4.25	$4.25	$4.95	$4.95

CRADLE RELAY SOCKET (includes retaining clip)

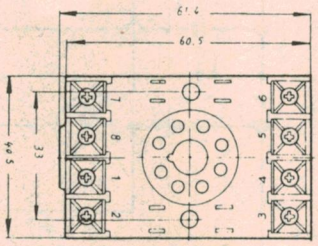
To suit Cradle Relays above Silver Plated.

	PRICE 1-9	10-24	25-99
S14508 For D.P.D.T. Relays (S14067/68)	$1.25	$0.90	$0.80
S14059 For 4.P.D.T. Relays (S14070/71)	$1.25	$0.90	$0.80

HEAVY DUTY OCTAL RELAY WITH SCREW BASE D.P.D.T.

Can carry 10A at 28VDC or 5A at 240VAC supplied with Chassis Mounting Socket with screw terminals. Great for school projects and demonstrations, switching DC Power Supplies, central circuits and with contacts parallel up to 20A can be switched.

PRICE	S14074
1-9	$8.95
10-24	$7.95
25-99	$6.95

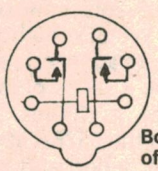


SCREW TERMINAL OCTAL

Socket (to suit S14074)

PRICE

1-9 10-24 25-99
S14075 $3.95



Bottom view of relay

HIGH RATING POWER RELAY

10A at 240V Can be switched single pole 12V coil voltage for safe switching of AC loads.

SPECIFICATIONS	
Contact Current (max)	10A
Contact Voltage (max)	240V
Nominal Coil Voltage	12V
Coil Resistance	160 ohm
PRICE	S14100
1-9	$9.95
10+	$8.95

12V AUTOMOTIVE RELAYS

HORN RELAY S.P.S.T.

Ideal for Horns, Ignition Circuits, Coils, etc.

Coil Voltage	12V
Contact Current (max)	20A
Contact Voltage	12V
PRICE	S14122
1-9	$4.95
10+	$4.25

DOUBLE POLE LIGHT RELAY

Extremely heavy duty for switching lamps, driving lights, isolating trailer or caravan circuits or on your boat. Both contact in Parallel yield a whopping 60 Amps for a single pole relay.

SPECIFICATIONS	
Contact Current (max)	2 x 30A
Contact Voltage (max)	12V
Nominal Coil Voltage	12V
PRICE	S14124
1-9	$12.95
10+	$11.95

ROD IRVING

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE (03) 489 8131.
48-50 A'BECKETT STREET, MELBOURNE, 3000. (03) 347 9251.

The phase locked loop synchronises the IC's internal timing circuitry to the mains frequency to ensure stability. The ignition angle limiter prevents firing outside of the acceptable phase angle range (this is nominally 35° for maximum brightness and 152° for minimum brightness).

For a more detailed description of the S576A's operation, refer to the Touch-lamp Dimmer article in the April 1983 issue.

We have seen that when the load is activated the timer circuit derives its power supply from the first 2ms of each mains cycle. However, when the load is not activated, the full mains cycle is applied to the Triac and we need some method of limiting the "charge" delivered by the charge pump. This is achieved by the 0.22μF capacitor and 1kΩ/1W resistor in series with the circuit's ground connection. At 50Hz, the capacitor represents an impedance of 15kΩ and thereby limits the current to an average of 16mA. The 1kΩ/1W resistor limits the peak current during each pulse.

The voltage derived from this power supply is zener regulated to about 15V by diode D5 and rectified by D3. These diodes operate in conjunction with the 0.22μF capacitor as a "charge pump" for the 100μF electrolytic. Power consumption when the load is off is about 0.25W which is too small to be registered by the domestic watt-hour meter.

Touch plate operation relies on the impedance of the body to ground. Normally the touch plate is held at active potential (240VAC) and is taken to ground (ie, below circuit ground) when touched. This transition is used to initiate the timing sequence.

Note that the touch plate is not connected directly to the circuit – rather, it is coupled through two series 4.7MΩ resistors. There are two very important reasons for this, both related to the fact that the circuit is operating at mains active potential.

Primarily, the resistors isolate the circuit from anyone operating the touch plate, removing the hazard of electric shock. For this reason, each of the resistors must be rated at 500V (minimum). We recommend the use of Philips VR37 high voltage resistors for this application although Philips CR52 are also suitable.

The resistors also protect IC1 (a 74C14 CMOS hex Schmitt inverter) which actually detects the input transition. The potential of the touch plate, when a hand touches it, will be considerably lower than the circuit ground. Normally, this is an unacceptable condition, with the IC's internal protection diodes being triggered into conduction. However, the 9.4MΩ resistance in series with the input limits the current through these diodes to a safe level, permitting the IC to operate in this mode indefinitely.

Only one of the six inverters in the 74C14 is used to detect the input transition. This is IC1a, with pin 9 being its input. To prevent false triggering, pin 9 is normally held high by a 1MΩ resistor. Since the output of an inverter is always in the opposite logic state to its input,

PARTS LIST

1 PCB, 83pc8, 47 × 71mm
1 HPM Decorator blank grid, DR770/GF blank
1 HPM Decorator blank metallic finish cover plate (DR blank)
1 3-way insulated mains terminal block
1 Neosid iron powder ring core, 17-132-10
1 1.2m of 0.5mm diameter enamelled copper wire
1 compression spring, 3mm dia × 5mm long, solderable wire

SEMICONDUCTORS
1 SC141D Triac
1 15V 1W zener diode
1 20V 0.4W zener diode
1 BC328 PNP transistor
1 74C14 hex Schmitt inverter IC
1 S576A light dimmer IC
3 1N4148 diodes

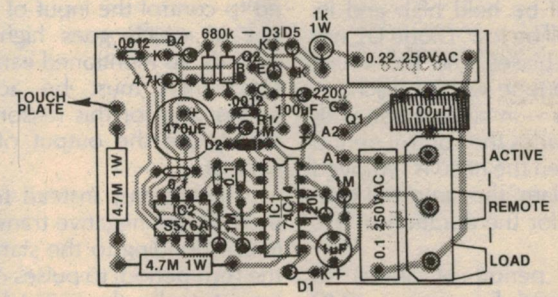
CAPACITORS
1 470μF/16VW electrolytic
1 100μF/16VW electrolytic
1 1μF/16VW electrolytic
1 0.22μF/250VAC metallised dieletric
1 0.1μF/250VAC metallised dieletric
3 0.1μF monolithic
2 .0012μF metallised polyester (greencap) – see text

RESISTORS (¼W, 5% unless stated)
2 x 4.7MΩ 1W (Philips VR37 or CR52), 4 x 1MΩ, 2 x 680kΩ, 1 x 120kΩ, 1 x 4.7kΩ, 1 x 1kΩ 1W, 1 x 220Ω

Remote extension

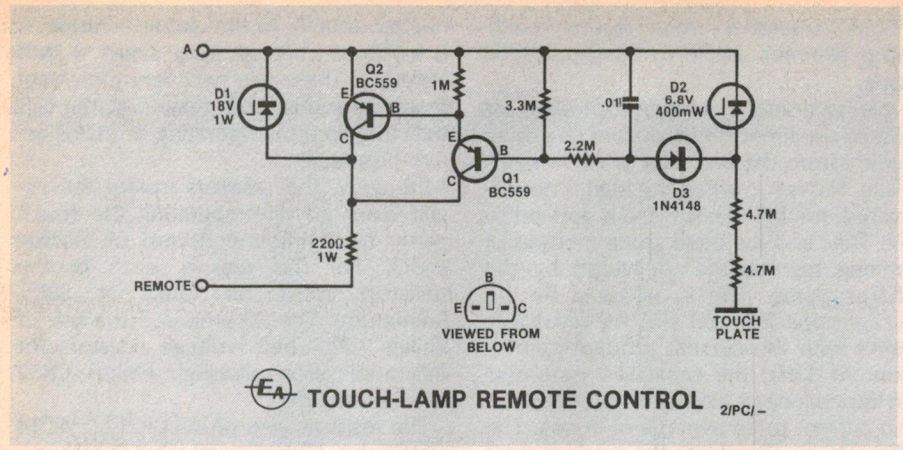
1 PCB, code 83pc3b, 47 × 72mm
1 HPM Decorator blank grid, DR770/GF blank
1 HPM Decorator blank metallic finish cover plate (DR blank)
1 2-way insulated mains terminal block
1 compression spring, 3mm dia, 5mm long, solderable wire
2 BC559 PNP transistors
1 18V/1W zener diode
1 6.8V/400mW zener diode
1 1N4148 small signal diode
1 .01μF metallised polyester capacitor

RESISTORS (¼W, 5% unless noted)
2 x 4.7MΩ Philips CR52 or VR37, 1 x 3.3MΩ, 1 x 2.2MΩ, 1 x 1MΩ, 1 x 220Ω 1W.



Make sure that all polarised components are correctly oriented.

The PCB is affixed to the back of the switch plate using epoxy adhesive. Contact with the metallic touch plate is by means of a small spring (see text).



This optional circuit can be used for remote switching.

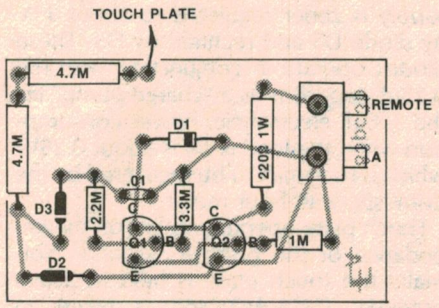
the output of IC1a (pin 8) will be normally low.

Notice that pin 8 is connected to the anode of diode D1 which will normally be reverse biased. This allows C1, a 1μF electrolytic, to be discharged by the 120kΩ resistor across it.

Suppose that the touch plate is now taken low. This will cause the output of IC1a to go high, forward biasing D1 and charging C1. As soon as the touch plate is released, C1 will begin discharging, providing a delay of about 125ms. The purpose of this network is to ensure reliable triggering – even with the lightest touch on the touch plate.

Whenever C1 is charged, the input of IC1b (pin 13) will be held high and its output (pin 12) will be low. Diode D2 will thus be forward biased and the 470μF capacitor on its anode will be discharged. This capacitor – in conjunction with resistor R1 – provides the control period of the circuit. When the hand is removed from the touch plate, the lamp will continue to operate for the duration of this period.

The maximum period of about 10 minutes is achieved by using a 1MΩ resistor for R1. Reducing the value of R1 will have a proportionate effect on the delay.



Above is the parts layout diagram for the remote switching option.

The charge of the 470μF capacitor is used to control the input of IC1c, the output of which goes high during "on" periods. As mentioned earlier, control of the S576A must be achieved using pulses, and for this reason, we can not simply use the output of IC1c as the control.

It is necessary instead to convert the positive and negative transitions of pin 2 (corresponding to the start and finish of the "on" period) to pulses of 100ms duration. Actually, the S576A has two inputs (pins 5 and 6) with opposite sense so that either positive or negative pulses can be used. In the original Touch-lamp Dimmer, pin 5 (which requires negative pulses) was used with the main touch plate and pin 6 to the remote sensor.

The output of IC1c is connected to two other inverters (IC1d and IC1e) via 0.1μF capacitors. Pin 3 of IC1d is normally held low by a 1MΩ timing resistor and thus receives a 100ms positive pulse when the output of IC1c goes high. This corresponds to a negative pulse on pin 4 which is fed to pin 5 of the S576A, causing it to activate the load.

Pin 5 of IC1e is normally held high by a 1MΩ resistor which means that it ignores the positive transition on pin 2 of IC1c but registers a 100ms negative pulse at the negative transition of pin 2. This is inverted and applied to pin 6 of the S576A, causing it to deactivate the load at the end of the timing period.

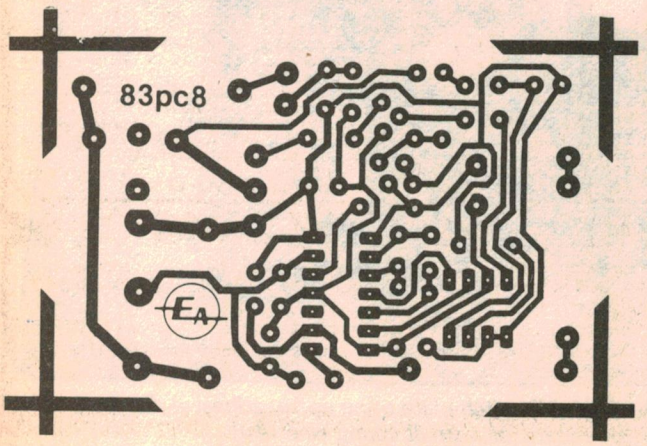
The output of IC2 is pin 8 which drives the base of transistor Q2 via a 4.7kΩ limiting resistor. In the Touch-lamp Dimmer, pin 8 was used to drive the Triac gate directly. We found that, under certain conditions, this would not reliably trigger the Triac for fan motor loads. The transistor buffer increases the drive to the Triac to solve this problem.

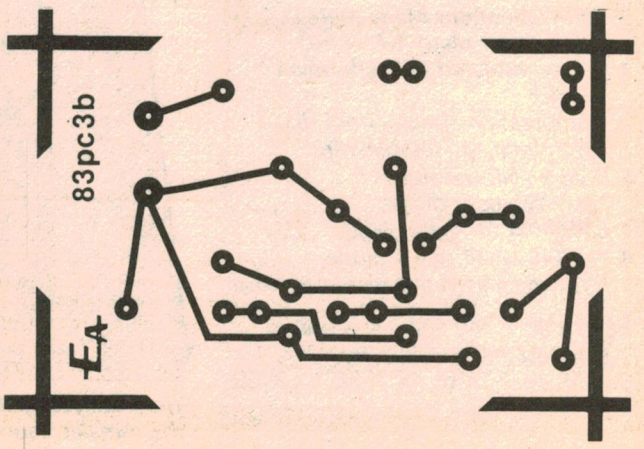
With some types of fans – particularly those with larger motors – it may also be necessary to change capacitors C2 and C3. If the fan does not start reliably, increase the value of C2 and, if necessary, C3. Neither of these two capacitors should need to be larger than .0047μF and it is preferable to use the smallest values which will permit reliable starting as larger values cause the fan to operate at reduced speed.

Triac Q1 drives the load via the 100μH toroidal choke. This choke, in conjunction with the 0.1μF capacitor, is used to suppress the considerable electromagnetic interference which is usually generated in this type of switching circuit.

The phase locked loop input to IC2 (pin 4, the sync input) is derived from the Triac A2 terminal via two 680kΩ resistors and a series 20V zener diode. Together

Below are actual size reproduction of the two printed circuit boards.





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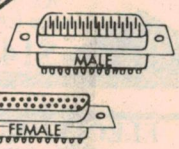

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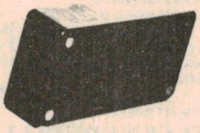

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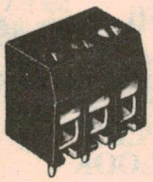

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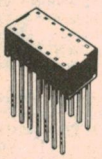

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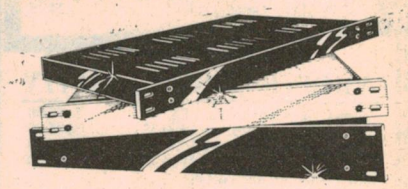

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with the two .0012μF capacitors, this network forms a two-stage filter which makes the circuit proof against the effects of mains interference. Without this filter network, mains borne interference (such as control tones) could upset the operation of the circuit.

The Touch-lamp Dimmer remote extension required only a single connection to the main dimmer circuit and one to the mains active. If necessary, the active connection could also be made at the dimmer terminal block. We have designed the timer to be compatible with this system.

The extension feeds into the main timer circuit at the cathode of D1. Recall that this is normally low, going high only when the circuit is triggered. The remote extension output is normally floating and also goes high when triggered, thus making it directly compatible with the timer circuit.

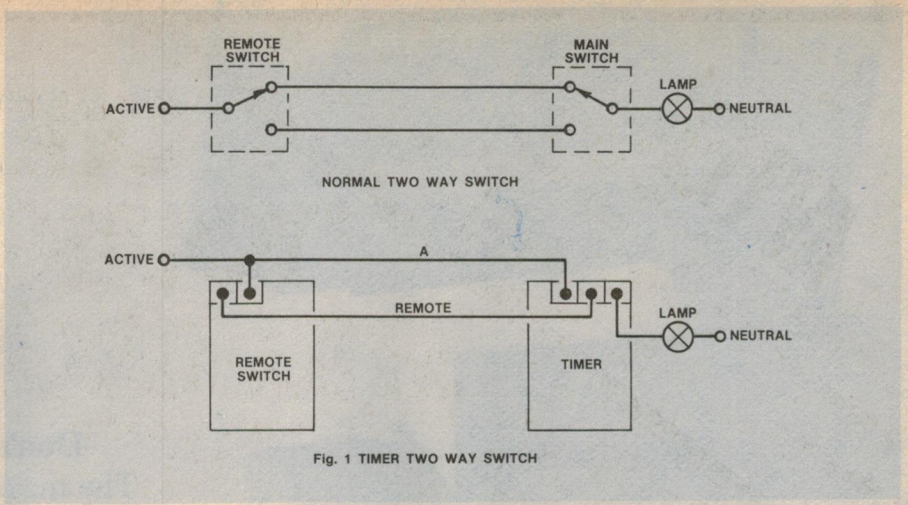


Fig. 1 TIMER TWO WAY SWITCH

This diagram shows how the timer and remote switch can replace an existing two-way switch installation.

Construction

The printed circuit board (PCB) used for this project is coded 83pc8 and measures 47 x 71mm. Components on the PCB are packed in rather tightly and this means it is important to solder them in the correct order. Put D2 and R1 in place first – if you leave them until later, it will be a matter of inserting them with tweezers!

The next component to install is IC1, followed by the rest of the resistors and diodes. The capacitors (greencaps, monolithics and electrolytic) can then be soldered in place.

Put the PCB aside for a moment and turn to the toroid. This must be wound with 37 turns of 0.5mm enamelled copper wire. Wind each turn tightly so that it touches the adjacent winding at the centre of the core. When the winding is complete, twist the two ends together (a few twists will do). Leaving about 15mm of free length, strip the enamel from each end of the wire.

The wound toroid is secured to the PCB with a short piece of tinned copper wire strapping which is passed through the centre of the core. This wire is soldered into two holes on the PCB (adjacent to the toroid) and should be pulled tight before soldering.

The remaining components may be installed in any order except for the three-way terminal block which should be fitted last. The best way to mount it is to first insert three short pieces of tinned copper wire and then solder these into their respective PCB holes.

The timer PCB is centrally located on the rear of the grid plate and a hole drilled in the grid plate directly opposite the touch plate pick-up point on the PCB. We used a small spring made from solderable wire to provide the contact between the PCB and the touch plate. This spring is soldered at right angles to the copper side of the PCB, and protrudes through the hole drilled in the grid plate to provide a reliable contact.

We estimate that the current cost of parts for this project is approximately

$21

for the Touch-lamp Dimmer and $9 for the remote extension. These figures include sales tax.

Note that the HPM grid plate has eight plastic cylindrical protrusions on one side of the moulding. Four of these will have to be trimmed with side cutters to provide clearance for the PCB.

An alternative to using the spring for contact to the metallic decorator plate is to flare out the strands of multistrand hook-up wire and sandwich these between the front panel and plastic grid.

Isolation of the touch plate should now be checked. Use a multimeter set to measure the highest range. The resistance between the active terminal of the circuit and the touch plate should be about 10MΩ or you should get a very small deflection on the meter if the meter does not resolve resistances this high. This test will ensure that there is no fault at the touch plate likely to cause electrocution.

If the circuit fails this test, check firstly that the correct value resistors are used and secondly that there are no solder bridges from the resistors to any other tracks on the PCB.

Finally, the PCB should be affixed with epoxy resin to the rear of the grid plate.

Installation

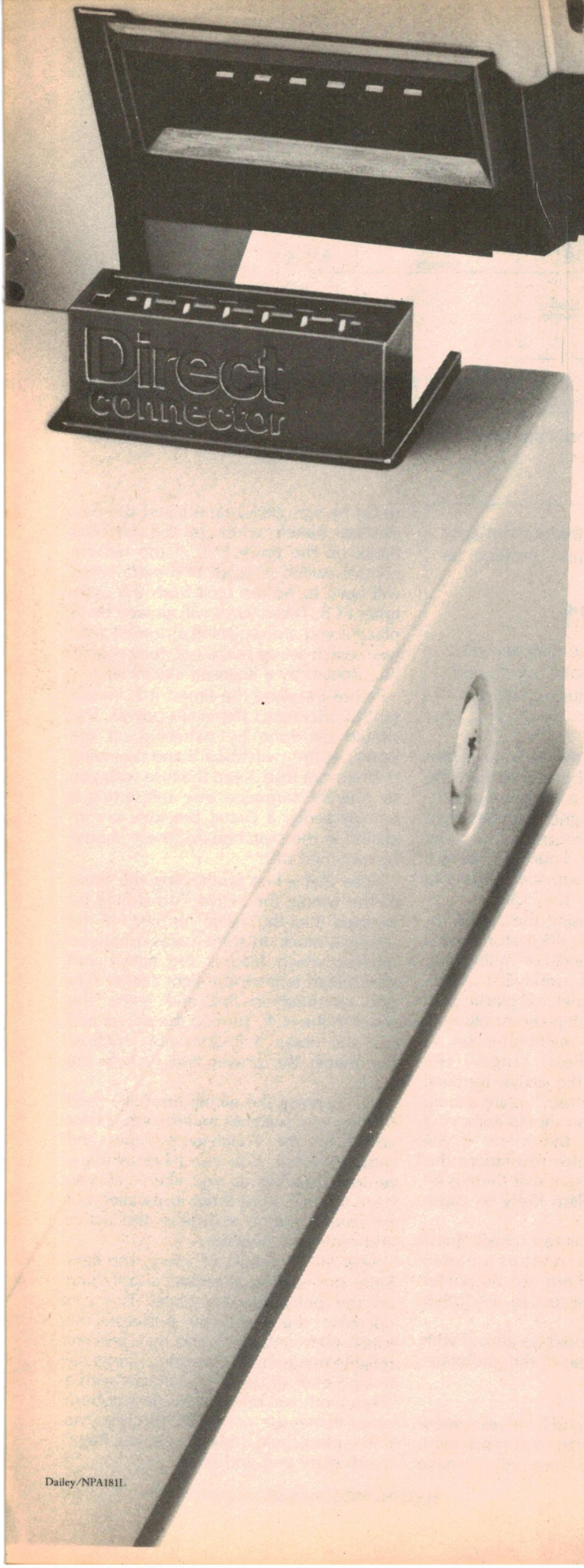
Installation is easy and involves removing the old switch plate and replacing it with the Touch-lamp Timer. All you have to do by way of wiring is insert the two existing switch wires in the terminal block on the timer PCB. If the remote control switch is used, two extra wires will have to be run to it from the main timer PCB. These wires will already be in place if you are replacing a normal two-way switch set-up but, if not, they should be installed by a licensed electrician.

Before installing the timer, it is important to disconnect the mains power. This should be done by switching off the power at the switchboard and removing the relevant fuse. Keep the fuse with you to prevent someone else reinserting it unexpectedly. If circuit breakers are installed in the switchboard, these should be switched off.

Note that when connecting the timer to the wiring, the active lead should be inserted into the inside terminal of the terminal block. In some cases it may be unclear which lead is the active and which lead is from the light socket. Try one combination first and screw the timer to the wall. Turn on the power and test the timer. If it does not function, disconnect the power and reverse the leads.

Fig. 1 shows the wiring normally used for two-way switches and the equivalent wiring for the Touch-lamp Timer and remote switch. You can have as many remote switches as you like – all you have to do is wire them in parallel, but be careful not to transpose the active and remote connections.

After some period of usage, the light timer may collect dust and an oily film on the polycarbonate plate. This can decrease the resistance between the touch plate and earth and may prevent reliable triggering of the timer. Generally a wipe over of the front surfaces with a clean cloth will remedy this. In stubborn cases it may be necessary to clean the entire plastic grid and between the metal touch plate and grid plate.



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Add a video input to your TV set

Video amplifier for computers & VCRs

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead. It's much better.

by JEFF SKEEN

Up until now, the most common method of obtaining a display from a computer (or VCR) has been to use an RF modulator to couple the signal into the TV antenna terminals. The main advantages of this approach are its simplicity and low cost. There is no need to spend hundreds of dollars on a separate display monitor and no need to delve into the "works" of a standard TV set to find a suitable entry point.

In fact, the enthusiast need know nothing at all about the TV set, its circuit, or its physical layout. All he has to do is hook up everything as indicated in the computer manual, select the appropriate unused channel, and fine tune for the best picture. Usually, the signal level out of the modulator will be equivelent to a strong local TV signal so the resulting display should be of reasonable quality.

At least that's the theory!

Unfortunately, as many users have come to realise, the RF modulator method has several significant drawbacks. Typical problems include interference patterns (particularly with some colour computers), images that waver, and text outlines that are not as sharp as they should be. Most of these problems are related to limited bandwidth and to RF radiation, both of which degrade picture quality.

In addition, an RF modulator can cause significant interference to other TV sets in the vicinity.

It's not surprising that the modulator approach has its limitations. First, the computer generated video has to be converted to an RF signal and this inevitably involves some losses. Add to this bandwidth limitations in the tuner and IF stages in the TV receiver and it's easy to understand why video modulators cause problems, particularly with high resolution computer graphics.

Fortunately, there's a low-cost solution to these problems. The trick is to make a direct video connection to the TV set, thereby eliminating the troublesome RF modulator and bypassing the tuner and IF stages. Provided the job is done properly, the result will be a rock-steady picture with sharper images and no interference.

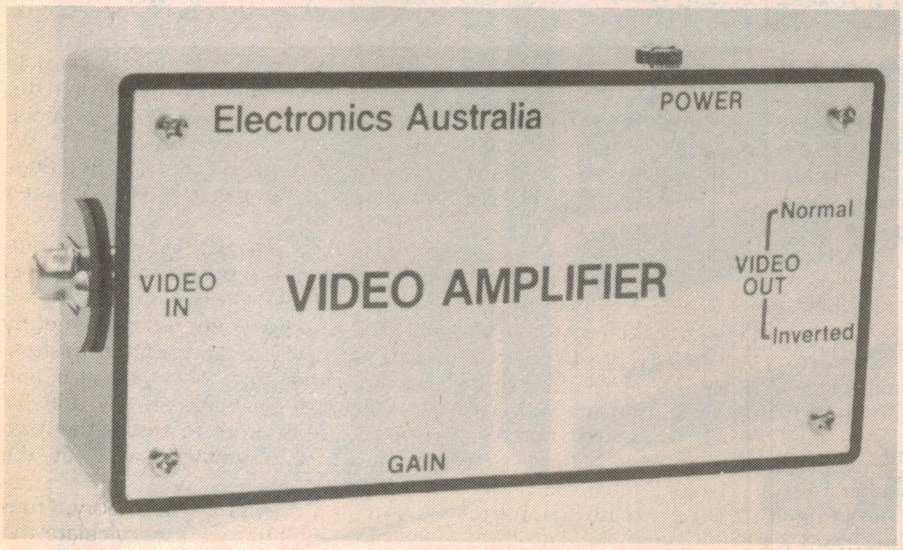
Finding an input

The input to the first video amplifier – ie, immediately following the video detector – is the most logical first choice to couple in a computer video signal (see Fig. 1). Provided that you have access to a circuit diagram, you should be able to find the appropriate spot in the circuit without too much difficulty. Ideally, the circuit will also show the amplitude and polarity of a composite sync/video waveform which is normally present at the input to the video amplifier stage, when signals are being received.

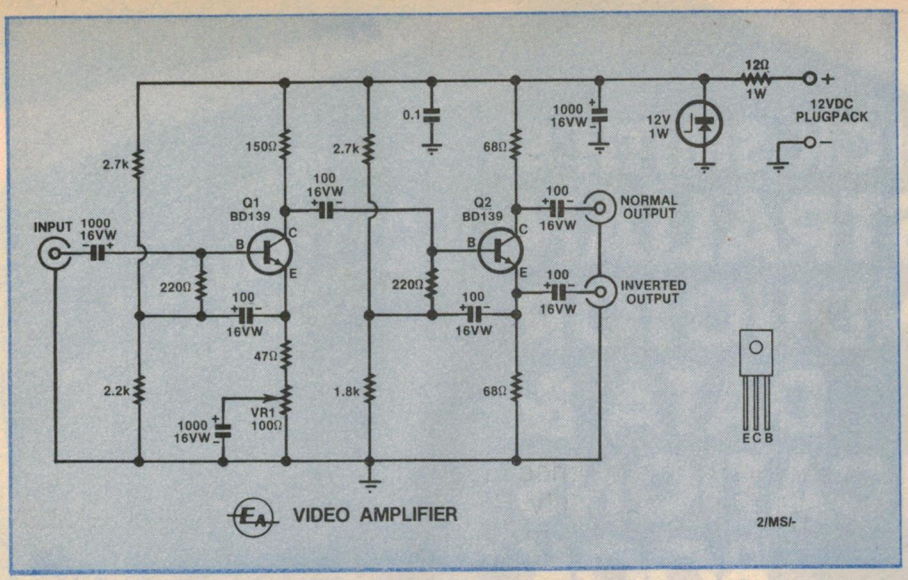
If you are lucky, the selected point will have the same signal polarity as that of the computer signal and will operate at a similar level. If this is the case, the computer signal can probably be AC-coupled directly to the video input via a 1000μF 25VW electrolytic capacitor. The polarity of the capacitor can be determined by measuring the DC voltage between the computer output and the TV input (don't forget to tie the two earths together).

In most cases, however, it may not be quite that simple. Often, the signal amplitude from the computer may be insufficient to drive the video amplifier, or the signal polarity may be the reverse of that required by the TV set. In the latter case, the result will be poor or incorrect picture sync and a negative (ie, reversed) picture.

Our Video Amplifier is designed to overcome these problems. It features an adjustable gain of between one and



The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply.



The complete circuit diagram. Q1 provides a gain of between one and three times while Q2 acts as a buffer and phase splitter to produce the normal and inverted waveforms. Below is a view of the assembled PCB.

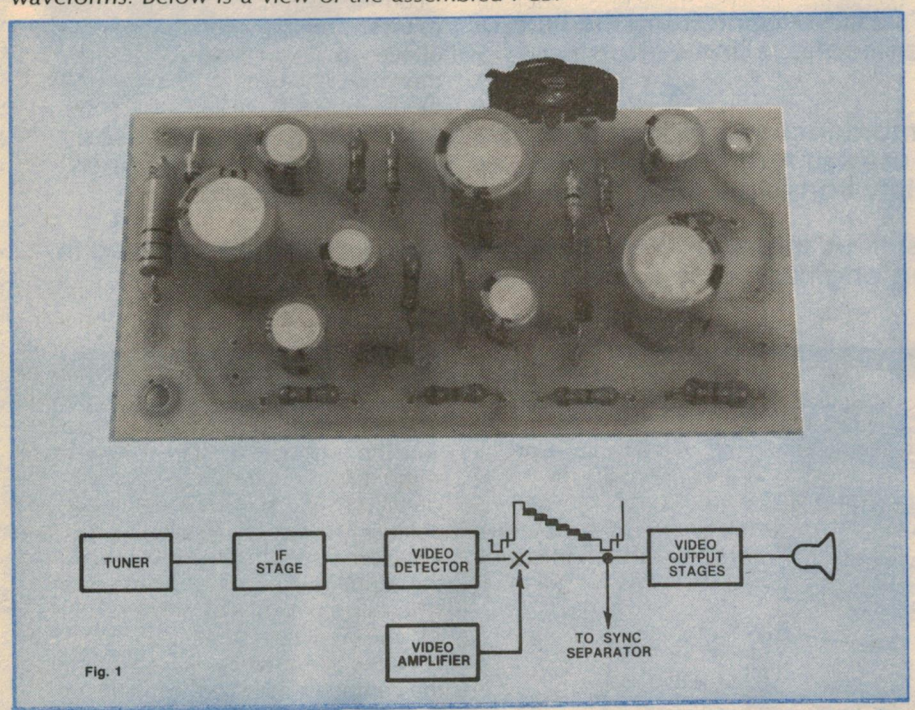


Fig. 1

three times so that you can match signal levels, and it provides both normal and inverted video outputs so that you can match waveform polarity. It uses just two low-cost transistors and can be used with most TV sets that employ mains isolation (see warning panel).

Apart from an interference-free display, the main advantage of using a direct video feed is the increase in available bandwidth. While this is not critical in the case of VCR signals, where the bandwidth seldom exceeds 3.5MHz, it can give a dramatic improvement to computer graphics and alphanumerics. In particular, it allows us to take full advantage of the video stage bandwidth which, in most TV sets, is likely to approximate 5.5MHz.

Of course, the bandwidth if the Video Amplifier must also be at least 5.5MHz. Our design easily exceeds this requirement. It has a bandwidth of 10MHz (−3dB point) at full gain, extending to 19.5MHz (−3dB) at unity gain.

By now some readers will be wondering whether the Video Amplifier can be used to provide a direct video feed from VCRs. The answer to this question is yes, although whether it's worth doing is another matter. Picture quality will probably be slightly improved but the drawback wil be the need to provide a separate sound circuit.

In some situations it may be possible to use the TV sound circuit while in others it will be easier to feed the audio signal from the VCR to your hifi system.

How it works

Refer now to the circuit diagram. The amplifier is a two-stage common emitter design with a gain adjustable between one and three and a maximum output of about 5V p-p from either output. This should be more than adequate to cope with the usual combinations of computer video output levels (which typically range from 1V p-p to 3V p-p) and TV video input requirements. All of the gain is produced by the first stage, while the second stage acts as a buffer and phase splitter to produce both normal and inverted output waveforms.

The video signal from the computer is AC-coupled into the base of Q1 via a 1000μF capacitor, while the 2.7kΩ and 2.2kΩ resistors set the base bias to slightly less than half supply. Althouth not strictly necessary, this first stage has been bootstrapped by connecting a 100μF capacitor and series 220Ω resistor from the emitter back to the base. This increases the input impedance so that loading on the computer video output is minimal.

We'll take a closer look at how bootstrapping works a little later on.

The AC gain of Q1 is set by the ratio of the collector load (150Ω) to the emitter load. Trimpot VR1 and its associated 1000μF capacitor vary this gain by bypassing part of the emitter resistance. Note that a large value bypass capacitor is necessary as the symmetrical nature of the video waveform can cause the voltage on smaller capacitors to fluctuate, resulting in a distorted display.

The signal output from the first stage is taken from the collector and AC-coupled into Q2 via a 100μF capacitor. Q2 is bootstrapped in a similar manner to Q1 and functions as a unity gain amplifier since the collector and emitter loads are the same. As already mentioned, Q2 also acts as a phase splitter, the normal output appearing at Q2's collector and the inverted ouput appearing at the emitter.

The 100μF capacitors on the outputs provide AC-coupling between the amplifier and the TV set. They allow the signal to be coupled to the TV set without upsetting the DC bias conditions on either the amplifier or the TV video input.

It is normal practice to make the output impedance of the video amplifier as low as possible to minimise loading effects. This requirement has been met by using 68Ω collector and emitter resistors. At the same time, Q2's collector and emitter must be biased to 9V and 3V respectively in order to ensure the maximum possible voltage swing at the outputs.

Now let's discuss a little theory. From the above criteria we can calculate the quiescent collector current for our output stage as 3/68 = 44mA. Assuming a

AT LAST!

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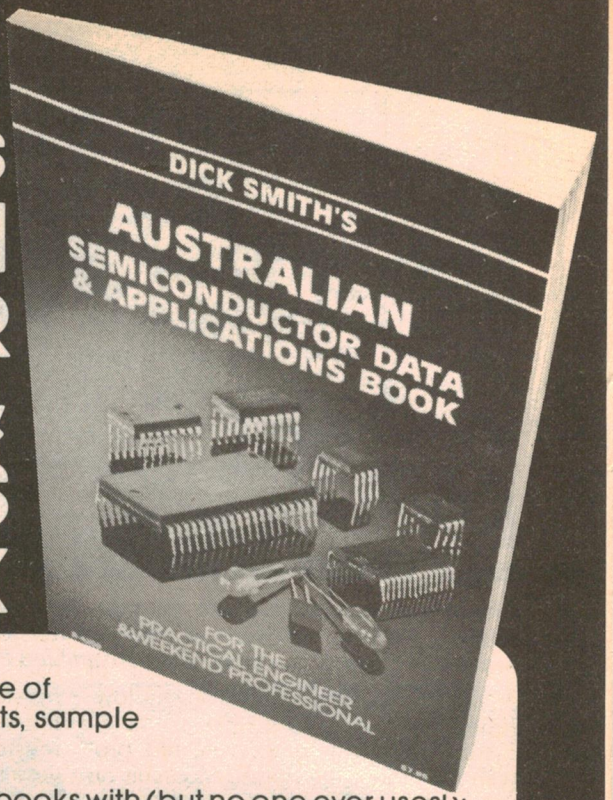

Cat B-4200

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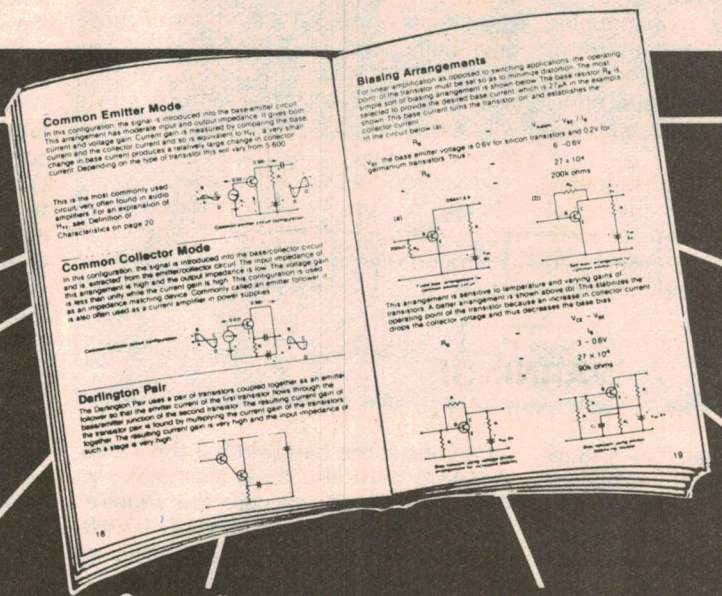
- ●TTL & CMOS ICs—types, specs, etc—with circuits, ideas, etc.
- ●LEDs, LDRs etc—specs, ratings & lots more circuits.
- ●Zener diodes—with basic theory, circuits, etc, plus specifications, how to work out zener wattage, different uses for zeners, etc.



- ●Op-amp theory, & and how to use them (including the latest types).
- ●Transistors (from signal to power)—how they work basic circuits, biasing, common transistor specs, and suggested usage.
- ●Unijunctions, FETs & SCRs—with lots of great ideas for circuits.
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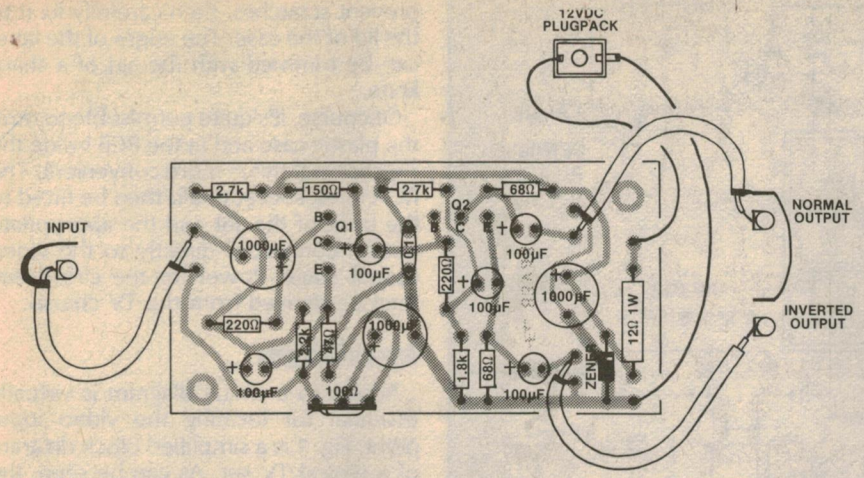
DICK SMITH Electronics

See page 98 for full address details

A517/TH

Video amplifier for computers



Only the RCA sockets and the power socket are not contained on the PCB.

minimum transistor beta of 40, Q2 requires a quiescent base current of around 1mA and thus a relatively low-resistance bias network.

And this is where we run into problems. Without the bootstrap circuit on Q2, the bias network is effectively across the signal input circuit (ie, 2.7kΩ in parallel with 1.8kΩ). Combine this with the low impedance offered by Q2 due to its low value emitter resistor, and the result is excessive loading on the Q1 output stage.

Hence the need for the bootstrapping circuit between the base and emitter of Q2. Its job is to increase the input impedance of this second stage, thus minimising loading effects on the output of Q1.

To understand how bootstrapping works, consider the fact that the signal voltage at Q2's emitter is almost identical to the base signal – ie, exactly in phase with it and only slightly lower in amplitude. By coupling the emitter signal back to the earthy end of the 220Ω resistor, we create a situation whereby the signal voltages at each end of the resistor are almost identical. As a result, very little signal current will flow in the 220Ω resistor and so it behaves as a high impedance, at least as far as signal voltages are concerned.

Bootstrapping thus effectively isolates the bias network so that it does not contribute to the loading on the previous stage. The input impedance of the second stage is now simply the transistor beta multiplied by the emitter resistance – ie, 40 x 68 = 2.72kΩ. This compares with an input impedance of around 770Ω without the bootstrap circuit, and reduces loading on the output of Q1.

Power for the circuit is derived from a 12V DC plugpack and is regulated by a 12V zener diode. The total current drain is around 85mA and, at this modest figure, a 12V plugpack will typically deliver 14V or more. The 1000µF and 0.1µF capacitors across the supply provide filtering and transient suppression.

Alternatively, many TV sets will have a well-regulated 12V supply rail which may be used in place of the plugpack supply. In this case, the 12Ω resistor and the zener diode should be deleted.

Construction

Construction is straightforward with nearly all the parts mounted on a small printed circuit board (PCB) coded 83va8 and measuring 94 × 48mm. Follow the layout diagram when installing the parts on the PCB and take particular care with polarised components. These include the transistors, diode and electrolytic capacitors.

The PCB is mounted in a small plastic zippy box measuring 130 × 67 × 42mm (L × W × H). A good idea of the general layout can be gained from the photographs. You will have to drill two mounting holes for the PCB, together with mounting holes for the RCA sockets and the plugpack socket.

A matching hole is also drilled opposite trimpot VR1 so that the gain can be externally adjusted using a screwdriver.

The wiring can now be completed according to the wiring diagram. Note that shielded cable must be used for the connections between the RCA sockets and the PCB. Don't forget the earth connection between the two output sockets.

The front panel label is made from Scotchcal material and gives the unit a

WARNING!

DO NOT USE WITH LIVE CHASSIS TV SETS

This project is suitable for use only with TV sets that have an earthed chassis and transformer isolation from the mains. **It is NOT suitable for use with sets that employ a live chassis.**

Before building this project, it will be necessary to determine which type of set you own. Generally speaking, sets that use a mains transformer or a switchmode power supply will be isolated from the mains and this can be confirmed by studying the circuit diagram or by direct inspection of the chassis. Most early Australian-made colour sets use a mains transformer, while many European designs favour the switchmode design approach.

Readers should note, however, that live chassis sets are increasing in popularity. This particularly applies to modern designs with screen sizes less than 48cm. Usually, if the set has a live chassis, a warning label will be attached to the rear panel. Do not, under any circumstances, attempt a direct video connection to this type of receiver.

If your set has a live chassis, then you will just have to use an RF modulator. Do not fool around with live chassis sets — unless you know exactly what you are doing they can be dangerous!

PARTS LIST

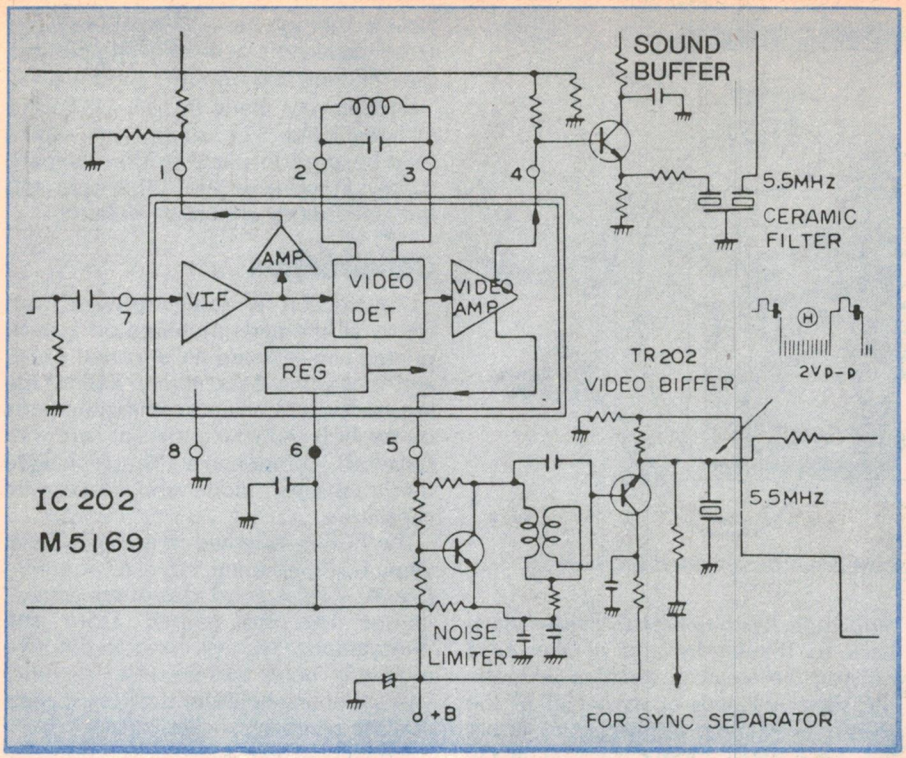
1 printed circuit board, code 83va8, 94 x 48mm
1 plastic zippy case, 130 x 68 x 42mm
1 3.5mm jack socket to suit plugpack supply
1 2-way panel-mounting RCA socket
1 panel-mounting RCA socket
1 Scotchcal label, 125 x 63mm
2 12mm PCB standoffs

SEMICONDUCTORS
2 BD139 NPN transistors
1 12V 1W zener diode

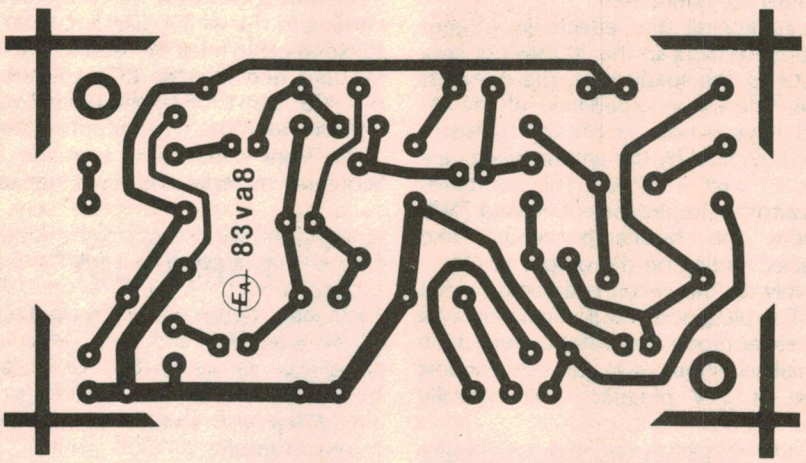
CAPACITORS
3 100µF 16VW electrolytic
5 100µF 16VW electrolytic
1 0.1µF ceramic

RESISTORS (¼W, 5% unless stated)
2 x 2.7kΩ, 1 x 2.2kΩ, 1 x 1.8kΩ, 2 x 220Ω, 1 x 150Ω, 2 x 68Ω, 1 x 47Ω, 1 x 12Ω 1W, 1 x 100Ω large vertical trimpot

MISCELLANEOUS
Machine screws and nuts, shielded cable (15cm), hook-up wire, solder, etc.



The base of transistor TR202 provides a convenient video input for this early-model Rank Arena set. Note the take-off to the sync separator.



Above is an actual-size reproduction of the PCB artwork.

professional finish. Spray the label with a hard-setting clear lacquer (eg, Estapol) to prevent scratches, then carefully fix it to the lid of the case. The edges of the label can be trimmed with the aid of a sharp knife.

Of course, it's quite permissible to omit the plastic case and fit the PCB inside the TV chassis if this is more convenient. The RCA input socket could then be fitted to the back of the set and the appropriate output connected directly to the video output stage. Power for the circuit can then be derived from the TV chassis.

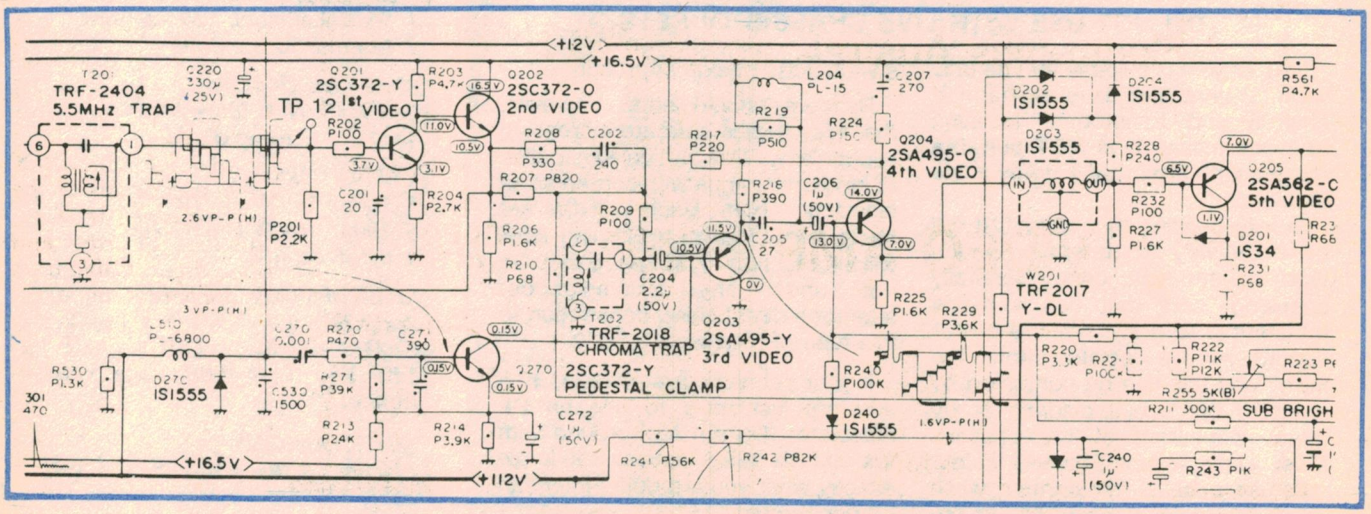
Installation

Access to a circuit diagram is virtually essential for locating the video input point. Fig. 1 is a simplified block diagram of a typical TV set. As can be seen, the output of the Video Amplifier is coupled into the video output stage, immediately following the video detector.

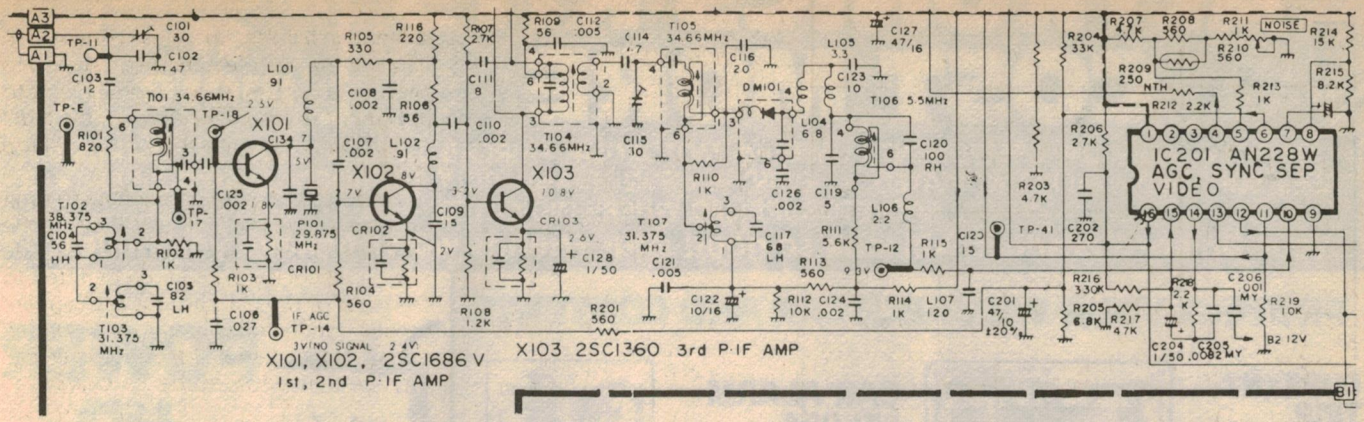
Also shown in Fig. 1 is a composite video waveform for a colour bar signal as it would emerge from the video detector. Quite often, a waveform of this type will be indicated at some point on the circuit diagram and this can serve as a useful guide. Note that, in some sets, this waveform may be shown inverted, in which case the inverted output of the Video Amplifier should be used.

It's also worth noting that some manufacturers provide a test terminal at the output of the video detector, and this can provide a convenient connection point. But whatever you do, make sure that you select an input ahead of the sync separator take-off point. If signals are fed in after this point there will be no sync pulses to lock the line and frame oscillators. The ideal connection point is the base of the first video amplifier stage.

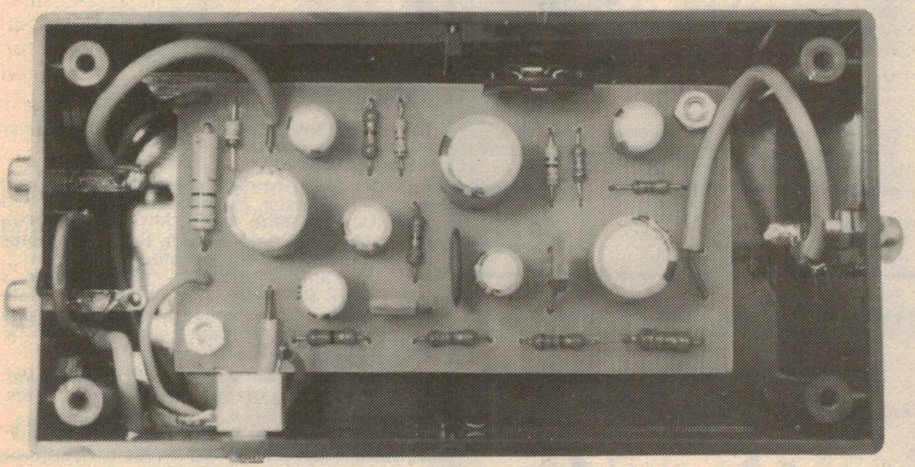
By connecting the signal to the base of the first video stage, any signal or noise from the preceding receiver circuitry will be swamped by the low output im-



Test point TP-12 (at transistor Q201) is the video input for this late-model Toshiba C-2021 receiver.



Test point TP-12 (immediately following the 5.5MHz sound trap) is the video input for this JVC receiver.



The PCB is mounted in the case using two 12mm stand-offs.

We estimate that the current cost of parts for this project is approximately

$15

This includes sales tax but not the plugpack supply.

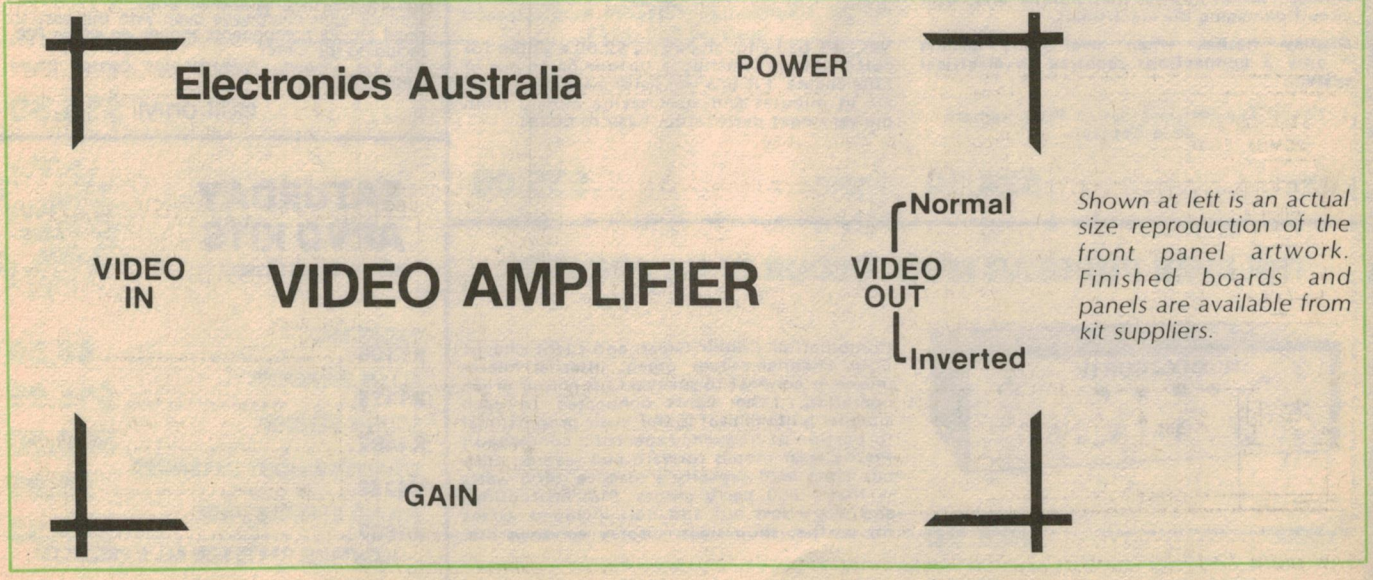
pedance of the external video amplifier.

In cases where a high impedance input cannot be found, it will be necessary to "kill" the front end noise by switching out the supply rail to the tuner.

Depending on the set design, it may also be necessary to reverse the output coupling capacitor. This can be checked by connecting everything up and then measuring the voltage across the capacitor. If the capacitor is reverse biased it will have to be removed and re-installed the other way round. Alternatively, if you are able to obtain 100μF bipolar capacitors, this step will not be necessary.

Finally, if you propose to use an old valve set for which no circuit diagram is available, it is usually possible to identify the video amplifier relatively quickly. Just take note of the single lead from the picture tube socket (ie, the video output lead) and trace this back to the appropriate valve. From there is should be easy to identify the grid. This can be done by measuring voltages – the grid will usually be a few volts negative with respect to chassis.

The same approach would apply to solid state black and white sets. The video output transistor can be found by tracing the video output lead from the picture tube back to its source. From there it's a matter of identifying the base of the transistor and then feeding the signal in as before. In some cases, it may be necessary to move back one or two stages to ensure that the signal is fed in prior to the sync take-off point.



Shown at left is an actual size reproduction of the front panel artwork. Finished boards and panels are available from kit suppliers.

ALTRONICS KITS COST MORE

Around $1 more

REASONS ★ PREMIUM COMPONENTS USED eg. MOTOROLA, FAIRCHILD etc. ★ QUALITY INSTRUMENT CASES SUPPLIED WHERE INDICATED ★ EVERY LAST NUT AND BOLT SUPPLIED, EVEN SOLDER ★ IC SOCKETS SUPPLIED WHERE INDICATED.

Your finished product will look so good your friends won't believe you built it.

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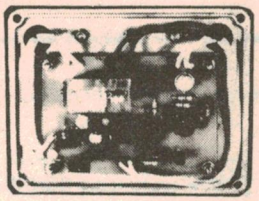
PROTECT YOUR VALUABLE CAR AND CONTENTS

CURRENT TRIP CAR ALARM

Exit / entry delay
No false alarms
State of the Art
Design by ETI

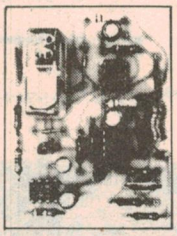


Protect Your Valuable Car and Contents

Circuit detects minutest voltage drop across vehicle's battery earth strap, tripping the alarm ★ uses Milspec LM394 ★ Quality diecast box ★ genuine fujitsu relay ★ automatic reset after pre set time period ★ installs in minutes ★ includes dash mounting LED-flashes to deter thieves.

K4330..... **$29.50**

CAR ALARM ETI 084



A staggering number of cars are stolen each year. Install an Altronics Alarm Kit and yours won't be one of them.

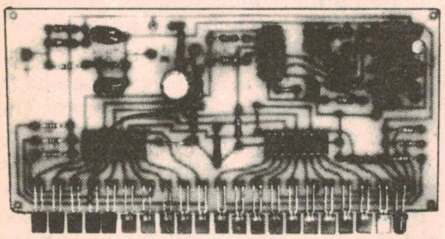
Circuit operates by detection of voltage drops in the electrical system and features a flashing LED for dash mounting as a deterrent to would be vandals and thieves.

K4084..... **$12.00**

MONITOR AND IMPROVE VEHICLE PERFORMANCE

TWIN RANGE LED TACHO

(SEE ETI AUGUST 1980)



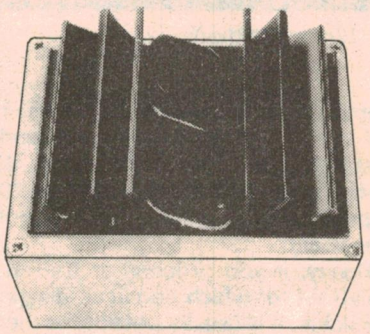
Unit suitable for 1, 2, 3, 4, 6 and 8 cylinder vehicles, 2 stroke or 4 stroke ★ fully compatible with conventional, CDI and transistorized ignition systems ★ includes protection circuitry to prevent noise and high voltage spikes from the points and coil circuit damaging the electronics. ★

Display flashes when over-reving occurs ★ only 3 connections required to electrical system.

Check The Performance of Your Vehicle At A Glance!

K4324..... **$24.50**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

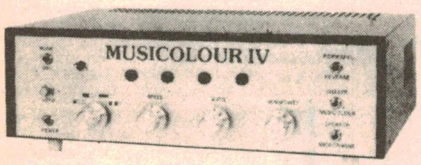


The Altronics Kit includes all components for the modifications, detailed by Electronics Australia Feb. 1983.

Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

K4010..... **$35.00**

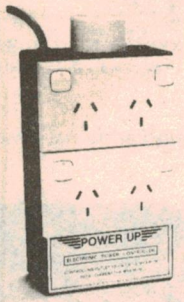
THE EVER POPULAR MUSICOLOUR IV EA PROJECT



Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward **and** reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K5800..... **$89.50**

See EA November, 1982



POWER UP

A MUST FOR YOUR COMPUTER SYSTEM

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What Does it Do?

A single 240v mains plug and lead feeds one unswitched master 240v outlet plus 4 switched 240v outlets. **With say a hi-fi system,** plug your main equipment item (e.g. Amp) into the master outlet and whenever you "switch on" your amp — presto — mains power is applied to the other 4 outlets i.e. simply "turning on" your amp turns on your tape cassette, tuner, turntable, graphic equaliser without mains spikes, plops etc.

Just the shot for your Computer System. The Altronics Kit includes case and all outlets.

K6000..... **$39.50**

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ETI PROJECT

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Monitor your microwave oven with this easy to build kit. All components mount on single PCB, including the meter.
Genuine Hewlett Packard Hot Carrier Diode supplied.

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(SEE ETI AUGUST 1983)

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RADIO MIC
K1106..... **$6.50**

ALIEN INVADERS
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COURTESY LIGHT EXTENDER
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SOUND EFFECTS PACK
K1607..... **$17.50**
(CONTAINS PARTS FOR ALL 5 PROJECTS)

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The Serviceman

De-gauss guesses and fuse confusion

Readers may recall that, in the June issue, I told a story about a National set which, initially, suffered from a purity problem due to failure of the de-gauss thermistor, followed by a series of thermistor and fuse failures for which no satisfactory explanation could be found. I promised to finish the story when I finally sorted things out.

In fact, I'm still not sure whether I have found all the answers, particularly as I seem to have unearthed a lot more questions in the process, but let's look at what happened and see what we can make of it.

First, there is the question of the set's precise model number. I hadn't mentioned this before because it didn't seem relevant at the time, but later investigation indicated that it was. It appears to be a model 22/32; I say "appears to be" because, in the first place, I could find no labels or other markings anywhere on the chassis or cabinet by which it could be identified.

The best I could do was compare the set with the photographs, circuit, and board numbers in the various manuals until I found an approximate match, and this was the model 22/32. But I say "approximate" because it wasn't an exact match. The model 22/32 in the manual was a hot chassis type – no transformer – whereas the set on the bench did have a transformer, and with every indication that it was the maker's own unit which had been fitted when the set was made.

JAPANESE MOD?

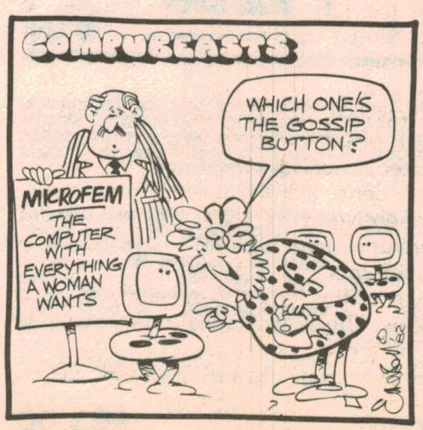
I imagine this may have been a Japanese modification, for the Australian market, made at a time when the hot chassis concept was still battling to establish itself here. And in case you think that this has little to do with the original story, let me assure you that it will turn out to be quite relevant.

To pick up the story where I left it, I took the first opportunity to lend the customer a set and bring the National back to the workshop. At this stage, readers may recall, it was fitted with a replacement de-gauss coil which, to date, had qualified only as a fuse blower.

I decided to go back to taws and refit the original de-gauss coil and a new National thermistor. Again, you may recall that this had functioned perfectly when mocked up on the bench, even in conjunction with another type thermistor. One reason for re-fitting this coil was the fact that the replacement coil differed physically from the original and I suspected that it might be drawing marginally more surge current.

So the old coil was duly fitted, and all the associated circuitry thoroughly checked for possible intermittent shorts, etc. None was found, and we faced the moment of truth. But before the big switch-on, I decided to take a punt on one modification; in place of the original 2A fuses I fitted a pair of 4A types.

This may sound rather drastic, but I reasoned that, at least on a temporary basis, they would still provide good protection to the rest of the set in the event of a catastrophic failure. On the other hand, if the de-gauss problem was simply one of marginal ratings – which I was beginning to suspect – then the heavier fuse should hold in, but would still blow if it was an intermittent fault in the coil or associated circuitry, as I had originally suspected.



So I held my breath, crossed my fingers, and pressed the switch. Nothing untoward happened; the set came on normally and produced a good picture. I switched off, allowed time for the thermistor to cool, then tried again, with the same result. Over the next few hours I repeated this cycle a couple of dozen times, each time with the same result.

Following this, over the next few days, I ran the set for long periods, interspersed with bouts of on-off cycling. It stood up to all of this without a murmur and, as far as I was concerned, the heavier fuses seemed to be the answer to the problem. But could I justifiably return the set to the customer in this form?

STRIPED APRON

Such an approach certainly smacks of butchery and I was less than happy about it unless I could find an explanation to justify it. One possibility that occured to me was that the fuses should have been of the slow-blow type, but I could find nothing in the manual to suggest this. On the other hand, there was a sticker in the set which said, simply, "FUSE 2AT", with no other qualification.

At which point I more or less bogged down and decided to put the problem aside for a few days, while continuing to run the set, in the hope that I could find an explanation. Which brings me up to something like episode seven, or perhaps eight, depending on how you count them.

Another National set, an earlier model (22/31), had come in for a quite different fault and I was working on it when, perhaps subconsciously, my eyes strayed to the fuse symbols. Imagine my surprise to find them clearly marked as 4A types. The result of this was to send me scrabbling through all my service data for sets around this vintage, in an effort to find some kind of pattern or preference.

Having confirmed, for the umpteenth time, that the fuse data for the model 22/32 specified ordinary 2A fuses, I went

over the other circuits and found what was, to me, a rather strange pattern. All the earlier model sets, fitted with a transformer, used 4A fuses, while the later, hot chassis, types, used only 2A fuses. And, I'm afraid, at that stage it didn't penetrate my thick skull as to why this should be so. Any ideas?

So where did this put the set on my bench? Shown in the manual as a hot chassis type with 2A fuses, was the modified version fitted with 4A fuses when the transformer was added? And what was the rating of the first set of fuses which blew when the first thermistor failed?

I am convinced now that they were 4A types and, with hindsight, I suppose I should have checked them. But with the cabinet sticker and the circuit both specifying 2A types there was no incentive to do so. I simply discarded them and thus destroyed what was really a valuable piece of evidence.

POSSIBLE SEQUENCE

Anyway, it would explain the events that followed. After the replacement thermistor shorted and took out the original (4A?) fuses I fitted a new thermistor and 2A fuses. Apparently these were nearly adequate, but not quite, and lasted only a few days. Following this, readers may recall, there were a couple more themistor failures, with suspicion falling on the replacement type and then, when the correct type also failed, on the coil itself.

So a new coil was obtained and fitted, only to behave as a "Little Beaut Instant Fuse Blower". The reason for this, I am now convinced, is because it draws marginally more current and so blows the 2A fuses instantly instead of taking a couple of days. Had I fitted 4A fuses, I have no doubt that either coil would have performed equally well.

All of which is very fine and supplies at least a part of the answer. But what about the succession of shorted thermistors? I can hardly blame the under rated fuses for that, and had previously refused to accept that such a sequence could be coincidence.

The most likely explanation would seem to be that the earlier failures, involving the non-standard thermistors, were due to just that; the fact that they were not exactly the same as the ones specified. That leaves one National type that failed for no apparent reason and that may be simply a case of Murphy's law.

And why the 2A fuses for the hot chassis models and the 4A types for the transformer versions? It took me a while to wake up, but I am virtually certain that the higher rating is needed to handle the heavier current caused by the transformer losses. Transformers in this power range would seldom exceed 70% efficiency, and could be as low as 50%, particularly with modern transformers which are designed to run quite hot.

On this basis, assuming that the 2A fuses had been selected to give the fastest possible protection, an extra 50% or so of current would be more than they could take on a long term basis.

At the practical level I have returned the set to the owner, fitted with the original coil, the correct type National thermistor, and a pair of 4A fuses. Only time will tell whether I have really solved the problem.

My next story also has some puzzling aspects to it, although it is on a quite different theme. It concerns a Toshiba model C812 and the fault seemed straightforward enough; sudden and total frame collapse while the owner's family were watching their favourite program.

(This particular Toshiba model was also sold under the Precedent label as model GC181. A lot of these were installed in motels and, in fact, I have another interesting story to tell about one of these, from the local motel. However, that will probably have to wait until next month.)

An important characteristic of these sets is that they use several double-sided boards, and these have proved to be a bit of a headache over the years, with more than an average number of dry joints. In particular I have encountered a lot of trouble where the circuit is taken from one side of the board to the other, either via component pigtails or through-board pins.

Anyway, I have found that a lot of problems can be solved in these sets by simply going over the boards and re-soldering these through-board connections. So this was my first step in this case, feeling moderately confident that it would probably cure the trouble and I would be on my way in short order.

WASTED EFFORT

Alas for my hopes. Maybe I cured, or forestalled, some dry joint problems, but the fault I was after wasn't among them. At that point I felt that the job would be better tackled in the workshop. These boards are not easy to work on in situ, and the job would be much easier to tackle on the bench where I had suitable extension leads and a better range of test gear.

I was also conscious of the fact that my stock of data on this model was rather limited, neither the Toshiba or the Precedent manual being very comprehensive, particularly the Precedent version, and neither carried any waveforms.

Nor is the circuit particularly easy to follow. The vertical output stage appears to be a complementary pair, 2SC1448A and 2SA740 (Q306 and Q307). However, the manner in which they are driven is

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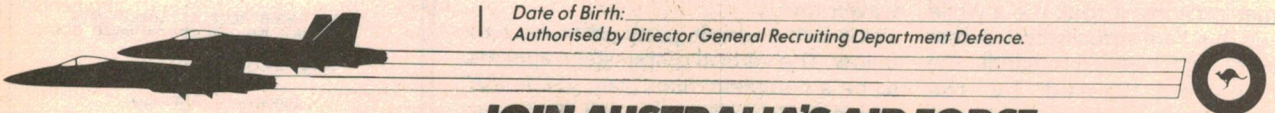

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AFAP 11.FPM.63

quite complex, and is not aided by quaint Japanese expressions used to describe the various stages.

The vertical signal originates in an IC, TA-7152, designated as a vertical oscillator and amplifier. As far as this fault was concerned there appeared to be three relevant pins: pin 5, pin 6 and pin 8. Pin 8 drives a 2SC1447 transistor (Q354) designated "Vertical Drive" and which does, in fact, appear to be the main driver for the output pair.

Pin 5 drives a 2SA495 (Q352) designated as "Vertical Switching Drive" and this is coupled to a 2SC1448A (Q353), designated "Vertical Switching", via a transformer (T351). The emitter of this stage appears to be coupled to the collector of the vertical output transistor, Q306.

The circuit from pin 6 appears to find its way to the bases of output pair via a quite complex R/C network, but also connects to the height control pot. Just how it all works is anybody's guess. (One network is called a "Pulse Clamper" and, in another part of the manual is called a "Pump Up", whatever that is.)

The only good thing about the circuit diagram is that it is well supplied with voltages, virtually every transistor pin being labelled. On this basis my first job was to make a voltage check, first around the output transistors, then the earlier stages, and then the appropriate IC pins. As far as I could tell, all appeared to be within acceptable tolerances.

Next I stoked up the CRO and began checking waveforms. This wasn't easy because, as I mentioned earlier, there were no waveforms in the manual. The best I could do was try to assess each one on the basis of experience. There appeared to be a reasonable kind of pulse out of pin 5 of the IC. Following this through the next two stages seemed to indicate that these stages were working correctly.

DOUBTFUL WAVEFORM

We also checked the waveform into and out of the so-called vertical drive transistor, and here we gained the impression that all was not well with the output waveform. While this could have been due to a faulty transistor, the voltages around it were almost spot on, and I hesitated to jump to this conclusion.

Rather, I was inclined to suspect something in one of the signal or feedback paths, particularly one of the electrolytic capacitors, of which there are several. Well, to cut a long story short, I checked or replaced several likely electrolytics, all to no avail, until I came to C333, a 2.2μF forming part of the aforementioned height control network.

I simply replaced this and, lo and behold, I had a picture. At that moment I imagined that this was the end of the story; all I had to do was tidy up and return the set. Unfortunately, this idea was short lived. A closer look at the picture made me suspicious, and I switched to a channel which was running a test pattern. Sure enough, the picture was badly cramped at the top.

This was not only surprising, but somewhat disconcerting as well, because this set has no vertical linearity control. Apparently, the circuit is designed to deliver a linear scan and, if it doesn't, one has to go looking for a faulty component. I didn't relish the idea, but there didn't seem to be any other approach.

THE HARD WAY

And so I went over the circuit, measuring resistors, pulling out capacitors, particularly electrolytics, checking them, and replacing them when there was any doubt, until I was convinced that I had checked everything that was likely to be responsible, all to no avail.

I was feeling rather desperate by now, and this inspired me to take another look at the electrolytic I had fitted in place of the faulty one. I had measured it on the capacitance meter before I fitted it, and its value was virtually spot on, but did it have some more subtle fault?

I tried another one of the same nominal value, 2.2μF, on the meter and found that it was high; closer to 3μF. So, with little to lose, I tried it instead. The result was rather surprising, in that it did improve the situation, but by no means cured it. After that I went through a whole swag of 2.2μF electros, measuring them and fitting them. All varied the linearity to some extent, but there didn't seem to be any relationship between the capacitance value and the effect on linearity.

The stock I had been drawing on was a rather motley collection, of mostly Japanese make, but of varying brands, and all those I had tried had been Japanese types. But there were also a couple of European types, and I finally grabbed one of these without much hope that it would be any different from all the rest.

In fact, its value on the meter was almost identical with that of the first one I had fitted, but I had long since ceased worrying about normal tolerance variations. So I fitted it and, would you believe it, the picture came up with absolutely perfect linearity.

Needless to say, I didn't stop to ask too many questions at that stage. The job had already taken more time than I could logically charge for so I simply let it run for a few hours on the bench, just in case, then took it back to the customer. And at a recent check it was still performing perfectly.

But why? Why would one particular capacitor, of the same measured value as another, behave so differently? Leakage seemed to be one possibility but, as far as I could measure it, the leakage was well within acceptable limits for all those that I tried. (One colleague went so far as to suggest that the circuit needed a leaky capacitor, and that the first one I fitted was too good, but I find that theory hard to support. If the circuit needed some bleed resistance, then surely the makers would have fitted it.)

The only explanation I can offer is that the unsuitable capacitors were suffering from relatively poor high frequency response; something which is common to all electrolytics, though it would seem to be unusual at the waveforms involved in a vertical circuit.

So, for the moment it remains a mystery. If anyone has encountered it before, or has any explanation, I would like to hear about it on behalf of other readers.

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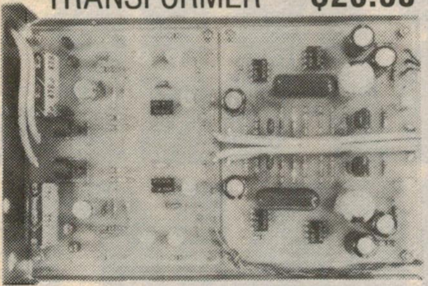

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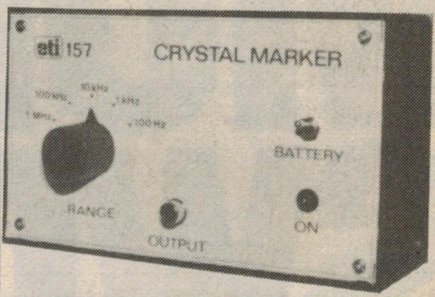

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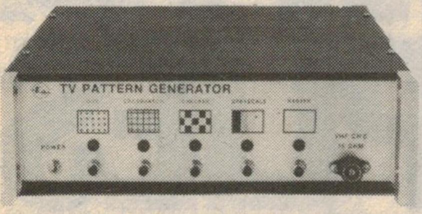

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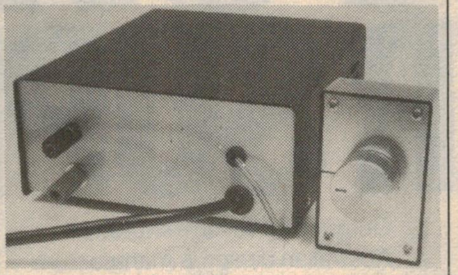

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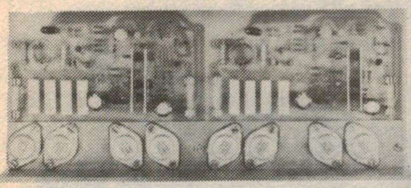

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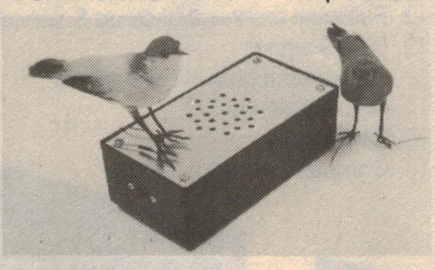

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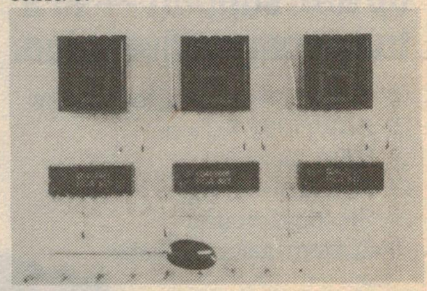

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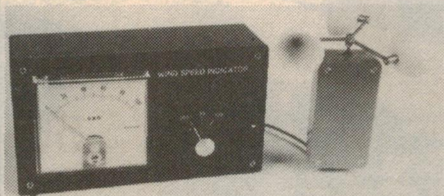

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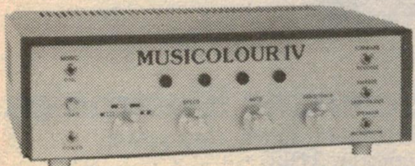

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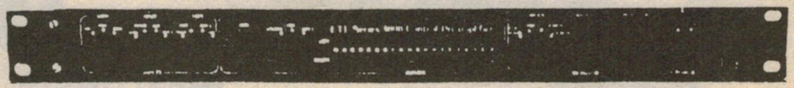

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Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Wide range low distortion sweep oscillator

While integrated circuit voltage-controlled oscillators can be readily made to sweep over a wide frequency range, they are not much use at frequencies of 1MHz and above. For these higher frequencies discrete semiconductors must be used but it is usually difficult to obtain a design which will operate over a very wide frequency range with low overall harmonic distortion.

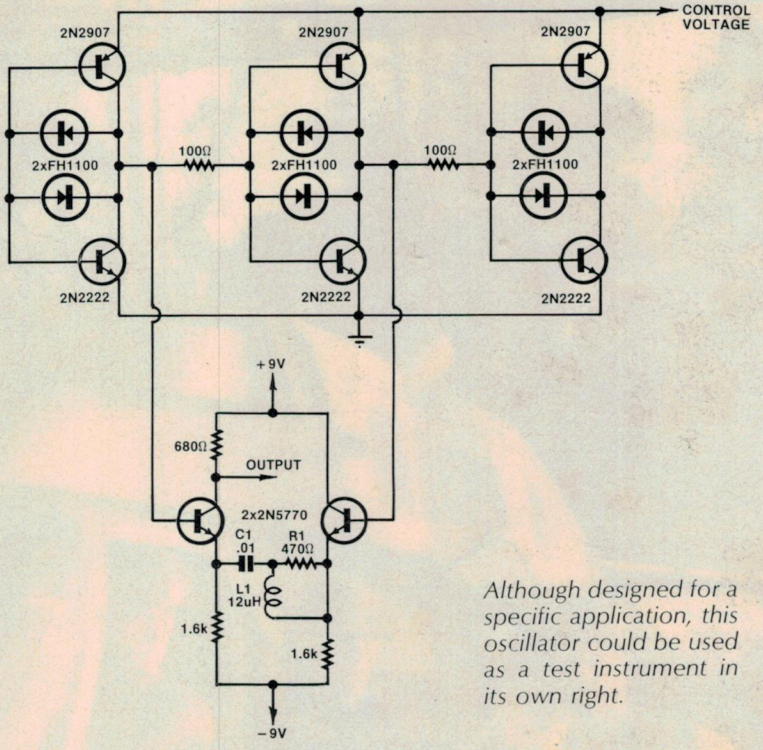
This triple inverter design meets those criteria. It will operate over the range from 300kHz to 70MHz with a control voltage of 0.5 to 2.5 volts while maintaining harmonic distortion at less than 3%.

The circuit uses three inverters, each using complementary transistors to obtain symmetrical rise and fall times and with diode clamps between base and emitters to prevent each stage from saturating and so minimise odd harmonics.

The frequency of oscillation is controlled by varying the collector current of each inverter stage and, as might be expected, the higher the control voltage, the higher the frequency of oscillation.

At the same time, the output signal amplitude does vary, as a consequence of the varying control voltage. The signal amplitude is 0.5V peak-to-peak at 3MHz, 0.7V at 10MHz and 0.8V at 15MHz.

Complementary outputs are taken from successive inverter stages and fed to a differential amplifier (2 × 2N5770).



Although designed for a specific application, this oscillator could be used as a test instrument in its own right.

This effectively cancels the third harmonics which happen to be out of phase in successive stages. The generation of fifth harmonics is limited by the bandwidth of each stage while any tendency to parasitic oscillation is prevented by the 100Ω stopper resistors. The overall result is a clean sine wave.

The differential amplifier could also be used to compensate for the increased output amplitude at higher frequencies.

In its original application, the circuit was used in a proximity electronic access system for control and identification of personnel. The sweep oscillator was used to drive a sensing coil to search for resonances in a credit card key, in the range 3 to 30MHz.

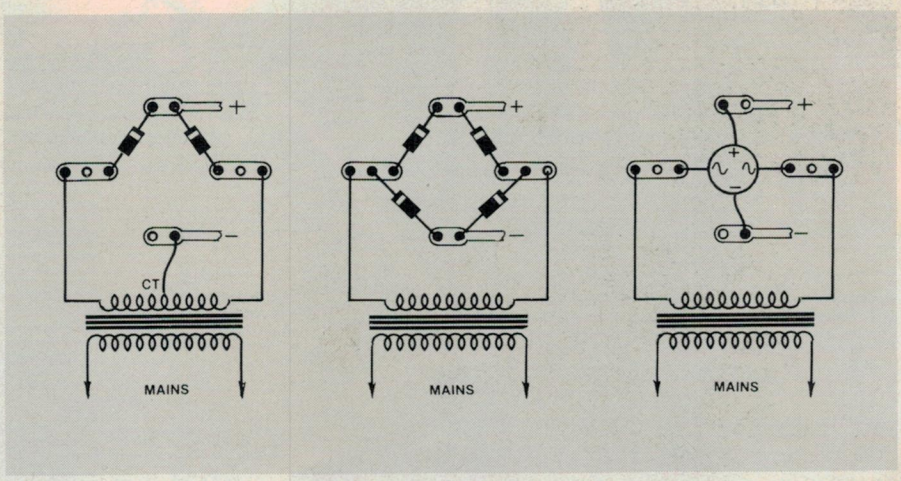
From "Electronics"
December 15, 1981.

PCB pattern suggestion

The printed board pattern shown here is suggested as a standard arrangement when setting out boards which incorporate power supply rectifiers. It is a universal arrangement which suits either a two-diode, centre tapped transformer arrangement, or a bridge rectifier in either encapsulated form or made from individual diodes.

By adopting this universal layout experimenters and home constructors can often save money by using whatever type of transformer happens to be available in the junk box.

B. Hunt,
Heathmont, Vic.



What's a bright young lad

like you doing in the Army?

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After that it gets a little tricky. Largely because once a young man completes his initial 44 weeks training at Officer Cadet School, Portsea, and graduates with a commission, his career can take a multitude of directions.

He might for example choose to enter an Infantry Battalion and become a Platoon Commander in charge of 30 men. In which case he'll obviously learn and be involved in different things to a man who flies a helicopter and commands a smaller crew. The same applies in areas like Armour, Artillery, Signals, Survey, Transport and Intelligence to name just a few.

There is, however, common ground on which every Officer stands. Irrespective of his rank or career choice.

All Officers are constantly involved in improving their ability to make rational decisions, bring out the best in their men and achieve professional results. They're regularly faced with new situations, new problems to solve and challenges that test them both mentally and physically. So they can ill-afford to rest on their laurels. Once you become an Officer, the learning process never stops. There's always something to do and a better way of doing it.

In short, life as an Army Officer is exhilarating, varied and very satisfying. You're given every opportunity to realize your potential as a leader, and be recognised for your achievements.

If you're aged between 18½ and 23 on entry (or up to 25 with a degree or diploma), have your HSC or equivalent (at a level acceptable to the Army) and would like to know more about what bright young lads do in the Army, contact your nearest Army Careers Recruiting Centre or fill in the supplied coupon.

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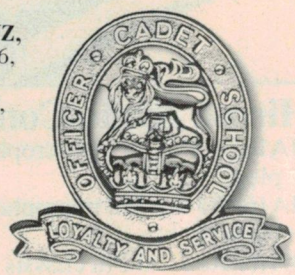

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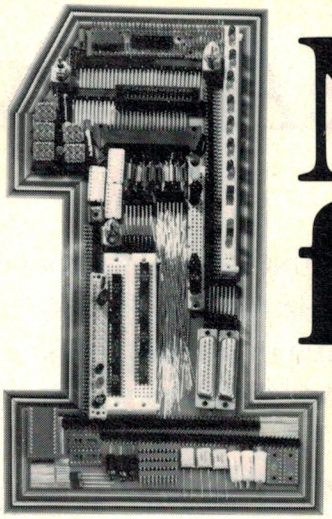

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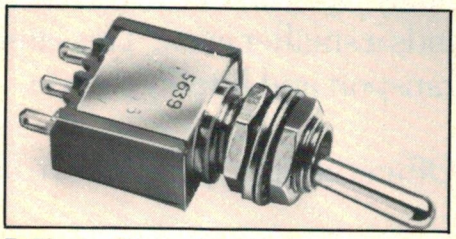

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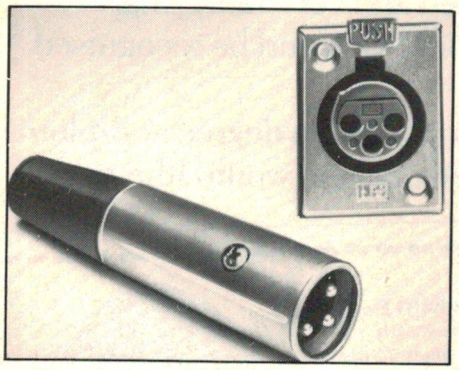

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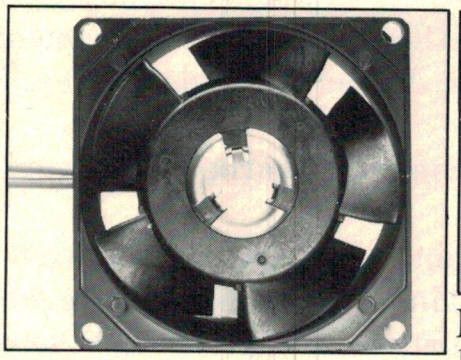

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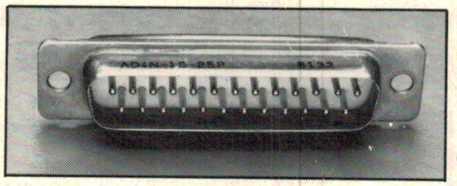

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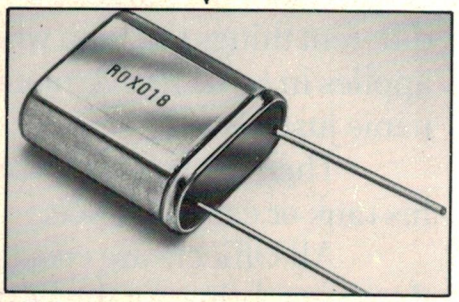
ADINIS50P – Solder cup	$3.95 ea
AD3S25S – 25 WY Wirewrap female	$6.10 ea
AD3525P – 25 WY Wirewrap male	$4.21 ea

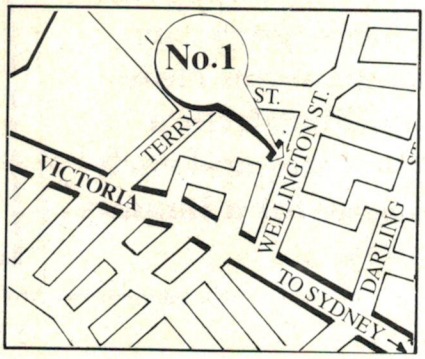


High Frequency Crystals

1 MHZ – HC33 Holder	$4.64 ea
2 MHZ – HC33 Holder	$2.78 ea
2 MHZ – HC18 Holder	$3.53 ea
2.5 MHZ – HC33 Holder	$2.78 ea
3 MHZ – HC33 Holder	$2.78 ea
3.2768 MHZ – HC33 Holder	$2.78 ea
3.2768 MHZ – HC18 Holder	$2.78 ea
3.330 MHZ – HC18 Holder	$2.78 ea
3.579545 MHZ – HC18 Hder	$2.38 ea
4.440 MHZ – HC18 Holder	$1.94 ea
5.9904 MHZ – HC18 Holder	$1.94 ea
6.1444 MHZ – HC18 Holder	$1.94 ea
6.5536 MHZ – HC18 Holder	$1.94 ea
8.8672375 MHZ – HC18 Holder	$1.94 ea
9.8304 MHZ – HC18 Holder	$1.94 ea
10 MHZ – HC18 Holder	$2.16 ea
10.73865 MHZ – HC18 Hder	$2.16 ea
15 MHZ – HC18 Holder	$2.16 ea
18 MHZ – HC18 Holder	$2.38 ea

Soar Digital Multimeters

Buzzer and 10 AMP range $45.00 ea



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Modified light chaser gives Cylon eye display

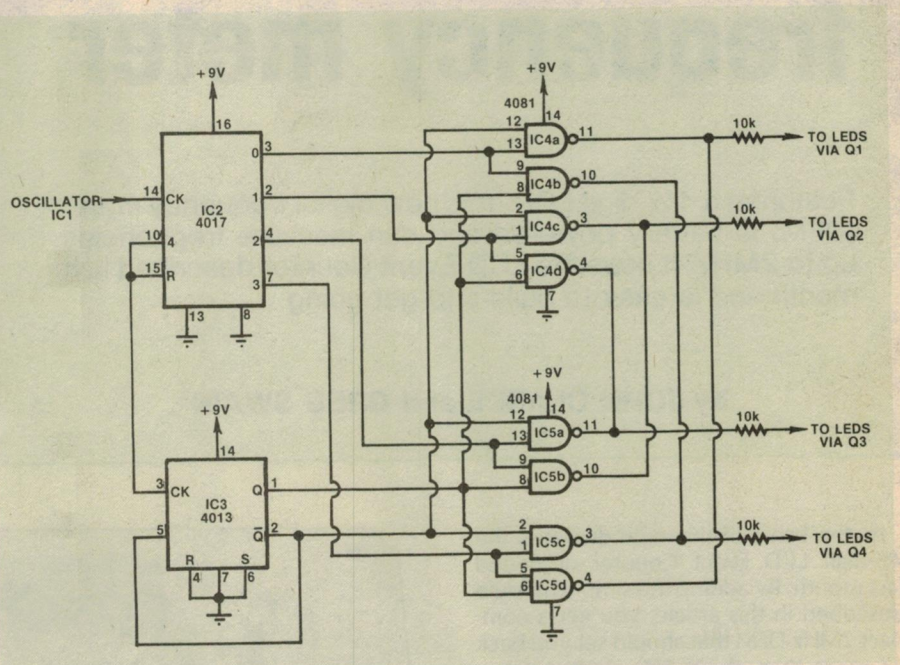
This circuit is a suggested modification to the "LED Head" Lightchaser of January 1983. It gives a simulated Cylon eye display, similar to that seen in the popular TV series. The LEDs chase alternately left, then right, then left again, etc.

A dual D-type flipflop, IC3, toggles at the end of each sweep with a clock pulse from the unused fifth output of IC2. When IC3's Q output (pin 1) is high the b and d AND gates of IC4 and IC5 are enabled, allowing the display to shift backwards. A high at the Q-bar output (pin 2) causes the display to shift forward via the a and c gates of IC4 and IC5.

The extra current drain from the three new CMOS chips should not be significant. Resistor and/or capacitor substitution in the oscillator will be necessary to give the desired sweep speed.

The LEDs could be glued into wraparound sunglasses, like the Boggle Goggles, or into a Cylon mask and teamed with the Cylon voice from the December 1980 project.

S. Johansen,
Nunawading, Vic.



This circuit replaces the 4017 IC in the January 1983 project.

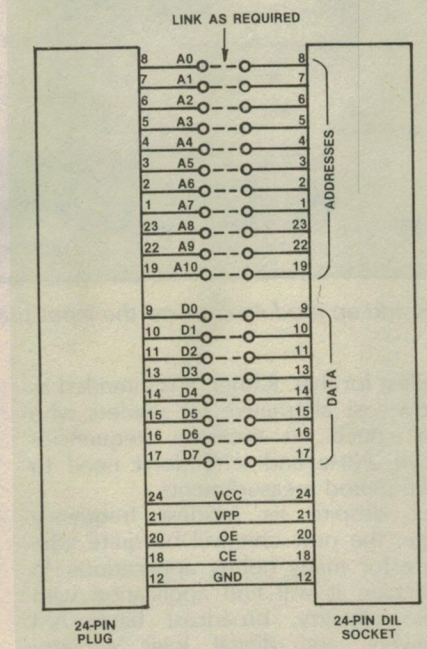
EPROM Adapter for EA Programmer

Users of the EPROM Programmer published in EA January 1982 may be interested in this useful EPROM Adaptor.

In laying out PC boards it is not always convenient to arrange board tracks and component layouts to make connections to the "officially" designated EPROM address and data pins. On reflection, it makes no difference whatsoever what names are given to particular address pins, and address pin names may be rearranged to best suit individual situations providing that the revised naming system is carriued through the programming process. Data pins may be treated in a similar manner.

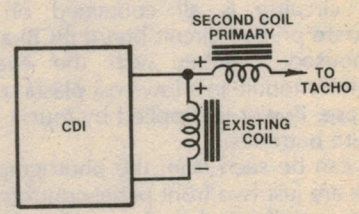
Using this approach, an adapter aboard can be constructed to allow interfacing of the EPROM programmer (using the "official" pin designations) to "customised" EPROMS. This method allows the normal programming sequence to still be followed, using the LED displays of the programmer. In PC board design, connections are now simply made to the closest or most convenient available address or data pin of the EPROM, making the board layout design task much simpler.

R. Martindale, VK3BMA,
Mill Park, Vic.



PSST! Got any neat circuit ideas? Why not send 'em to us? We pay between $5 and $20 per item, depending on how much work we have to do to publish it.

Tachometers and CD ignition systems



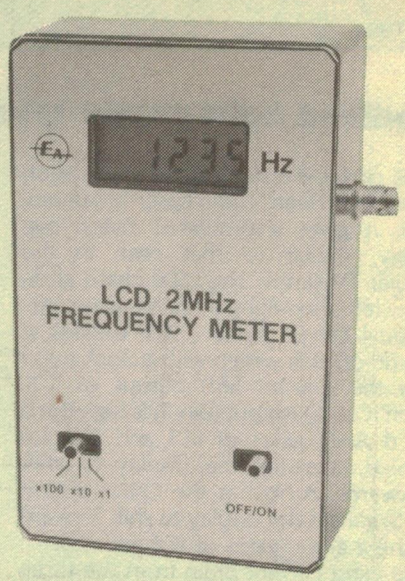
Many readers have fitted capacitor discharge ignition (CDI) to their cars, only to find that the tachometer no longer functions. This simple circuit works well with the impulse tachometer fitted to a Fiat 125, and may also solve the problem for other readers.

As shown in the circuit, it involves using a second coil which is connected in series between the tachometer and the positive terminal of the existing coil. No other components or connections are necessary. Used coils can be obtained cheaply from a wrecker's yard. In addition to driving the tachometer, this second coil could also serve as a spare if the main unit fails.

R. MacKenzie,
Scarborough, W.A.

Note: While this circuit was successful in the author's car, it may not work with tachometers in other cars.

2MHz 4½-digit frequency meter



Featuring a 4½-digit LCD, this new digital frequency meter (DFM) is battery powered and can measure frequencies up to 2MHz. It uses the LCD Event Counter described last month and is easy to build and get going.

by JOHN CLARKE and GREG SWAIN

At the heart of this new design is the 4½-digit LCD Event Counter described last month. By adding the simple module described in this article, you get a compact 2MHz DFM that should set you back no more than about $60. At that price, there's no excuse for not adding a DFM to your test equipment range.

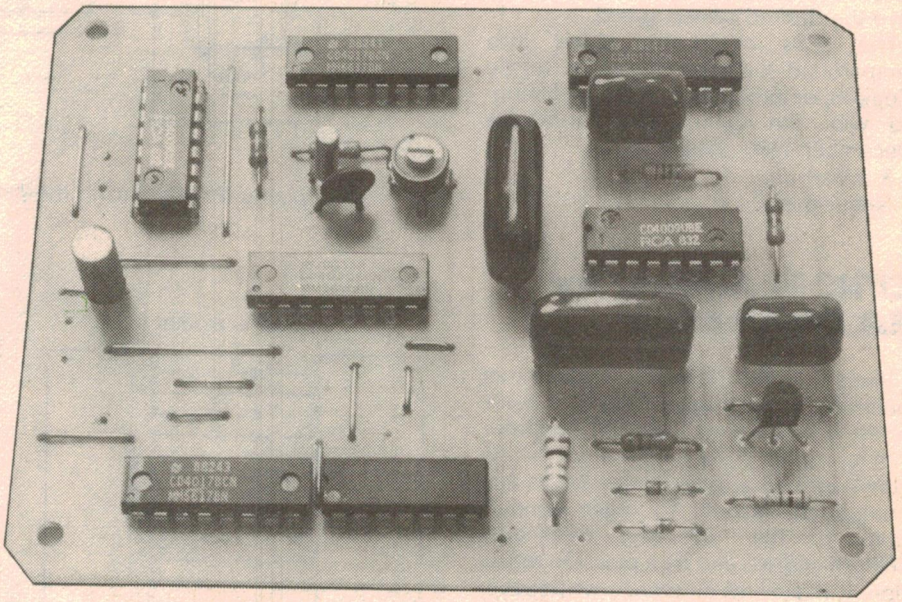
On board the add-on module is an input preamplifier and prescaler stage, a timebase, and housekeeping circuitry to provide the reset and store (latch enable) signals required by the counter module. This circuitry is all contained on a separate printed circuit board (PCB) and is housed together with the event counter module in a low-cost plastic zippy case. Power is supplied by four 1.5V penlite batteries.

As can be seen from the photograph, there are just two front panel controls: a power on/off switch and a range switch. In addition, the front panel carries the 4½-digit LCD, while the BNC input socket is mounted on one side of the case.

The range selector switch has three positions: 0-19.999kHz (x1), 0-199.99kHz (x10), and 0-1999.9kHz (x100). On the first range, measurements can be made with 1Hz resolution, while the second and third ranges have a resolution of 10Hz and 100Hz respectively. Other features include leading zero blanking, a 2s update time, and a sensitivity of around 200mV p-p from 20Hz to 2MHz.

Power consumption is fairly modest at less than 10mA. This is well within the capabilities of the battery pack (4x1.5V) and should give about 200 hours of continuous operation.

Before moving on to the circuit description, we should point out that this design in no way supersedes the 500MHz DFM described in December 1981. Its specifications are much too modest for that. Rather, it is intended as a low-cost alternative for readers who don't need to measure frequencies above 2MHz and who don't need to make period measurements.



This add-on module contains the input preamplifier and timebase circuitry.

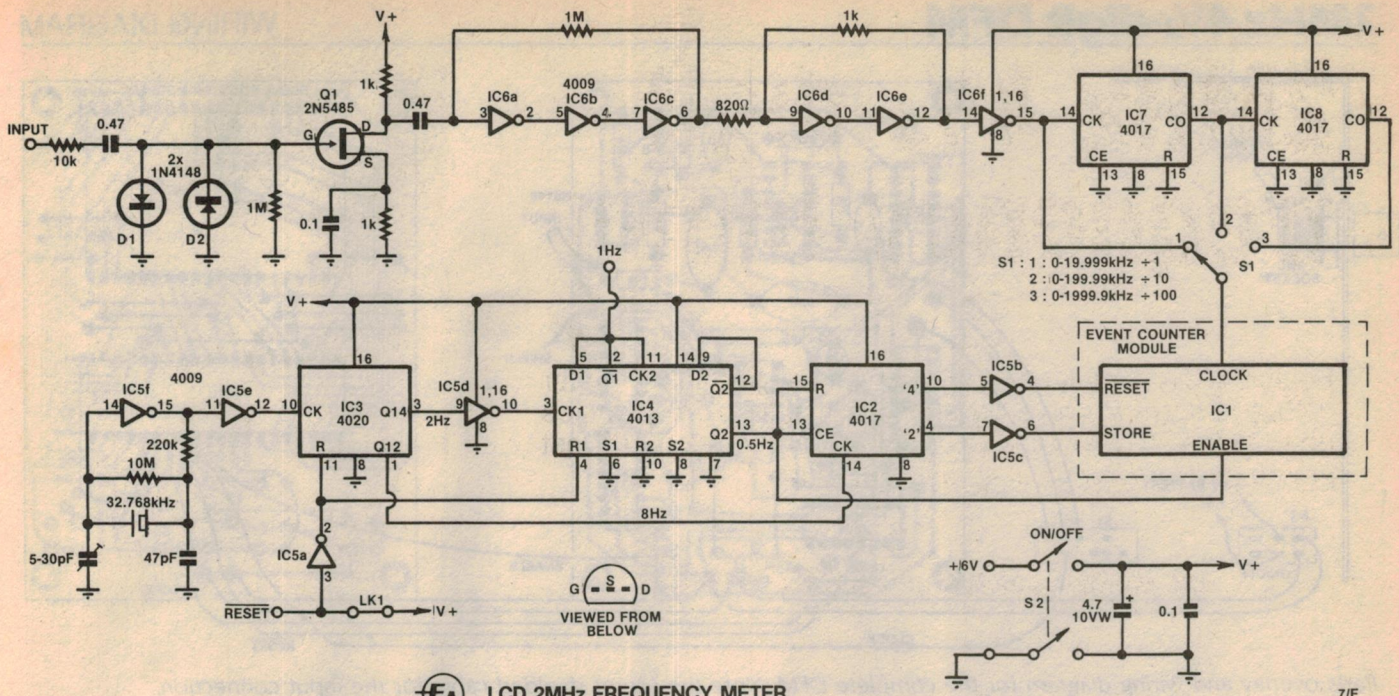
But despite its modest frequency range, the new unit will be quite adequate for many hobby applications. In particular, it will find application with audio circuitry, broadcast band AM receivers, and digital logic circuitry where frequencies of less than 2MHz are involved.

How it works

The circuit can be broadly divided into three sections: the event counter module (IC1); the input preamplifier and prescaler stage (Q1, IC6, IC7 and IC8); and the timebase and housekeeping circuitry (IC2-IC5). We dealt with the counter module in some detail last month, so we'll deal only with the additional circuitry for the add-on module.

Let's look at the input preamplifier and prescaler circuitry first. The input signal is coupled in via a 0.47μF capacitor and series 10kΩ resistor and fed to the gate of Q1, a FET buffer stage. Together with diodes D1 and D2, this input circuit clips the input waveform to 600mV amplitude to prevent damage to the preamplifier.

Q1 is a 2N5485 VHF FET arranged in common source configuration and with its gate connected to ground via a 1MΩ resistor. This resistor sets the input impedance to 1MΩ except for signals greater than 600mV p-p when the input impedance drops to 10kΩ. The 1kΩ



LCD 2MHz FREQUENCY METER

7/F

SPECIFICATIONS

RANGES: 0-19.999kHz; 0-199.99kHz; 0-1999.9kHz
SENSITIVITY: 200mV p-p from 20Hz-2MHz
INPUT IMPEDANCE: 1MΩ for signals less than 600mV p-p; 10kΩ for signals greater than 600mV p-p
RESOLUTION: 1Hz on x1 range; 10Hz on x10 range; 100Hz on x100 range
UPDATE TIME: two seconds
POWER REQUIREMENT: 6VDC, 10mA

source and drain resistors, together with the 0.1μF bypass capacitor, set the gain to around unity.

So Q1 functions merely as an input buffer stage with unity gain. Its output is taken from the drain and AC-coupled to a 4009 CMOS inverter chain (IC6). The first three gates, IC6a-IC6c, function as a gain block, while IC6d and IC6e are connected as a Schmitt trigger.

Note the 1MΩ resistor between the pin 3 input and the pin 6 output of the gain stage. This biases pins 3 and 6 to half supply – ie, to 3V – thus allowing IC6a-IC6c to operate in the linear mode. The gain of this stage is about 25 at 2MHz and is determined by the characteristics of the inverter gates.

Schmitt trigger IC6d and IC6e squares up the waveform from the gain stage and feeds it to buffer stage IC6f. Positive feedback for the Schmitt trigger is via a 1kΩ resistor which gives a hysteresis of 4.92V for a 6V supply. The value of this feedback resistor has been kept low so that the Schmitt trigger will operate satisfactorily to 2MHz.

Because the display only has 4½ digits, it is necessary to divide the input signal by 10 or 100 if we want to measure signals to 2MHz. This task is performed by a prescaler circuit consisting of two 4017 decade counters, IC7 and IC8. As can be seen from the circuit these two ICs are interconnected in a ripple clocking mode, ie. the carry output (CO) of IC7 is connected to the clock input (CK) of IC8.

IC7 thus divides the signal on its clock input by 10, while IC8 provides further division by 10 to give the divide-by-100 output. Switch S1 selects either the divide-by-one, divide-by-10 or divide-by-100 output and feeds the signal to the clock input of the counter module (IC1).

Timebase circuitry

Clock signals for the 2MHz DFM are derived from a single "pi-network" oscillator consisting of a 32.768kHz crystal and CMOS inverter IC5f. The 10MΩ feedback resistor biases the inverter in the linear mode so that it operates as a high gain amplifier, while the 220kΩ resistor presents the correct load to the crystal. A 5-30pF trimmer capacitor is provided to compensate for the frequency tolerance of the crystal.

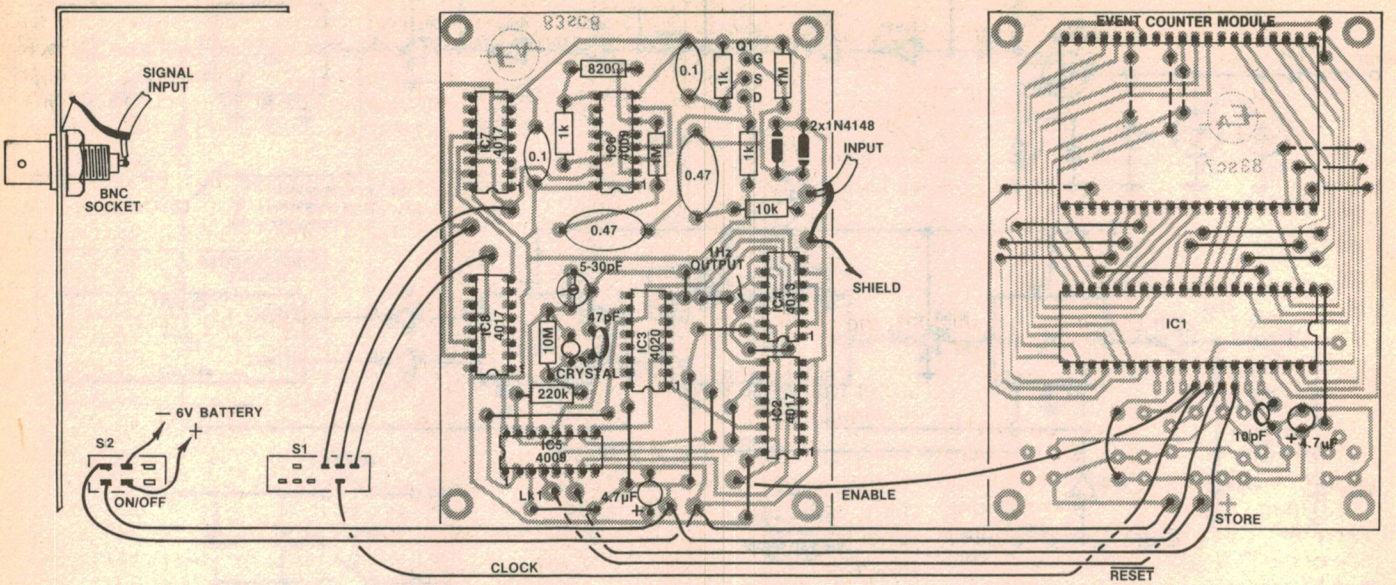
The 32.768kHz crystal is a miniature type commonly used in digital wrist watches. It was chosen because 32.768kHz is an easy frequency to divide and because the CMOS oscillator will operate at this low frequency from a 6V supply rail.

Three different pulse trains are derived from the timebase by the housekeeping circuitry to control the counter module: one second pulses for gating (enable), and 125ms pulses for store and reset. The enable pulse gates through the incoming frequency to the counters, the store pulse transfers the data from the counters to the output latches, and the reset pulse resets the counters to zero. Let's look at this in detail.

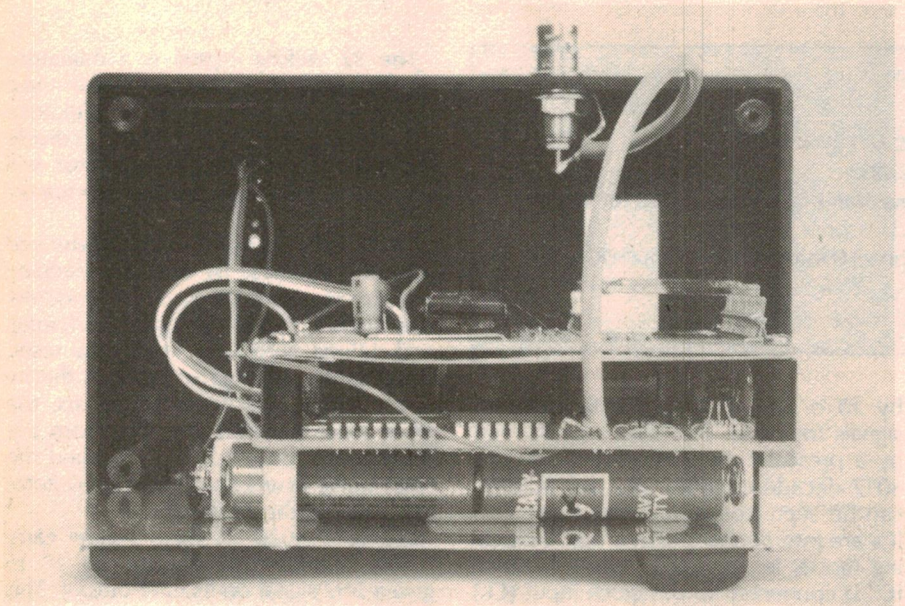
IC3 is a 4020 14-stage ripple carry binary counter that divides by 2^{14} to give a 2Hz signal on its Q14 output. This signal is buffered by inverter IC5d and fed to the clock input (CK1) of a 4013 dual D flipflop (IC4). Similarly, an 8Hz signal is derived from IC3's Q12 output and clocks IC2, a 4017 decade counter with 10 decoded outputs.

Dual D flipflop IC4 divides the 2Hz signal from IC5d by four, the resulting 0.5Hz signal appearing at its Q2 (pin 13) output. This signal is applied to the clock enable and reset pins of decade counter IC2, and to the enable input of the counter module. Gates IC5b and IC5c invert the "2" and "4" outputs of IC2 to provide the correct logic sense for IC1.

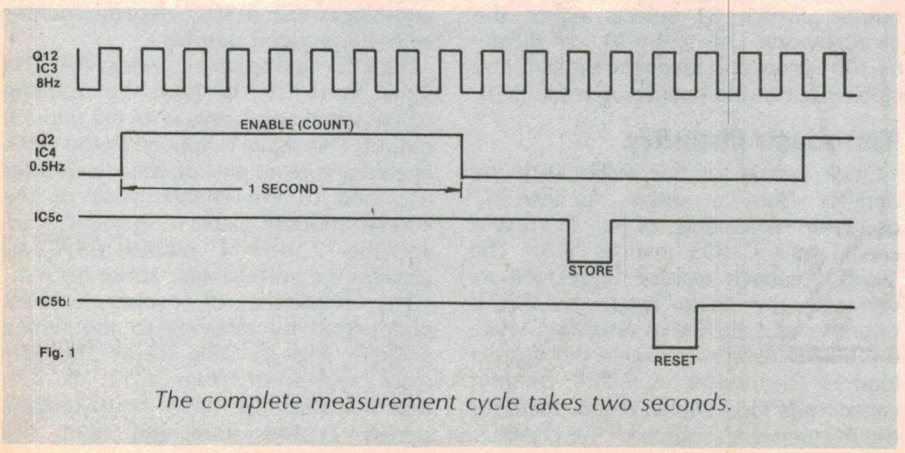
The sequence of events is best understood by referring to the timing diagram (Fig. 1). This shows the 8Hz clock waveform from Q12 of IC3, together with the three housekeeping signals; enable, store and reset. IC4



Parts overlay and wiring diagram for the complete DFM. Note the use of shielded cable for the input connection.



This view shows how the two PCBs are mounted on the lid of the case. Note the cardboard insulator and aluminium shield directly beneath the display PCB.



The complete measurement cycle takes two seconds.

generates the enable pulse, while the 8Hz waveform clocks IC2 to generate the store and reset pulses.

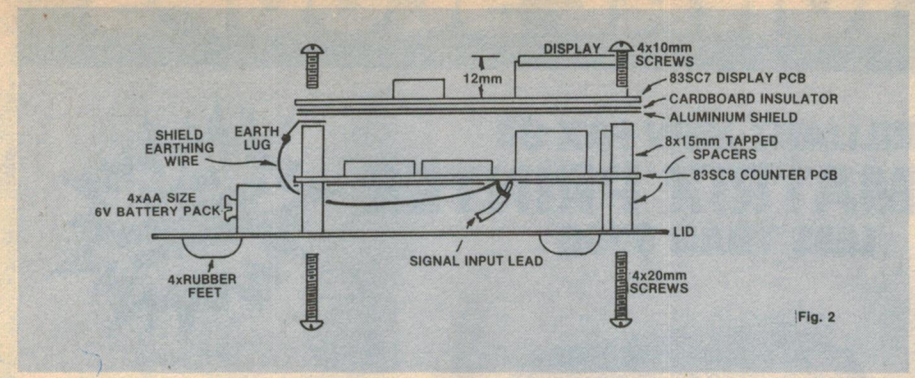
The basic measurement cycle takes two seconds. In the first second, the 0.5Hz output of IC4 goes high, resetting IC2 and gating through a one second burst of input signal to the counter (enable high). The output of IC4 then goes low, halting the counter operation and enabling IC2.

IC2 is now clocked by the 8Hz waveform from IC3. After a period of some 312.5ms, the "2" output (pin 4) goes high and a 125ms negative going pulse is delivered by IC5c to the store input of the counter. This pulse transfers the BCD count to the output latches to update the liquid crystal display.

Finally, 125ms later, the "4" output of IC2 goes high for 125ms and is inverted by IC5b to give the reset pulse. The measurement cycle is then repeated.

Note that it is necessary to slightly modify the event counter so that it can be used in the DFM. In particular, it is necessary to alter the circuitry associated with the clock, reset, store and enable inputs. The wiring diagram accompanying this article has the full details.

Note also that the event counter can be converted to operate as a seconds counter by connecting the 1Hz output from Q1 of IC4 directly to the clock input. In addition, link LK1 will have to be deleted and pin 3 of IC5a connected to the reset pin of the counter module to provide the reset function. The count may be stopped by using a momentary contact pushbutton switch circuit on the enable input, exactly as for the reset input (ie, switch plus 1MΩ resistor plus .027µF capacitor).



Don't forget to earth the aluminium shield to the signal input earth.

Construction

The preamplifier/timebase circuitry is built on a small printed circuit board (PCB) coded 83sc8 and measuring 78x102mm. Before commencing assembly, carefully check the copper side of the PCB and repair any faults that may be evident. This done, assemble the PCB according to the parts layout diagram.

The ICs are all CMOS devices and should be left until last. Take care to ensure that the ICs are inserted the right way round, and solder the supply pins (7 and 14 or 8 and 16) first. Similarly, check that the FET, diodes and electrolytic capacitor are all mounted with the correct polarity. The crystal may be soldered in either way round.

The completed PCB may now be wired to the counter module using short lengths of rainbow cable (see wiring diagram). At this stage, you should also solder short lengths of hook-up wire to the 83sc8 module for ultimate connection to switches S1 and S2. Although not strictly necessary, some readers may prefer to use PC stakes to make the job of wiring easier.

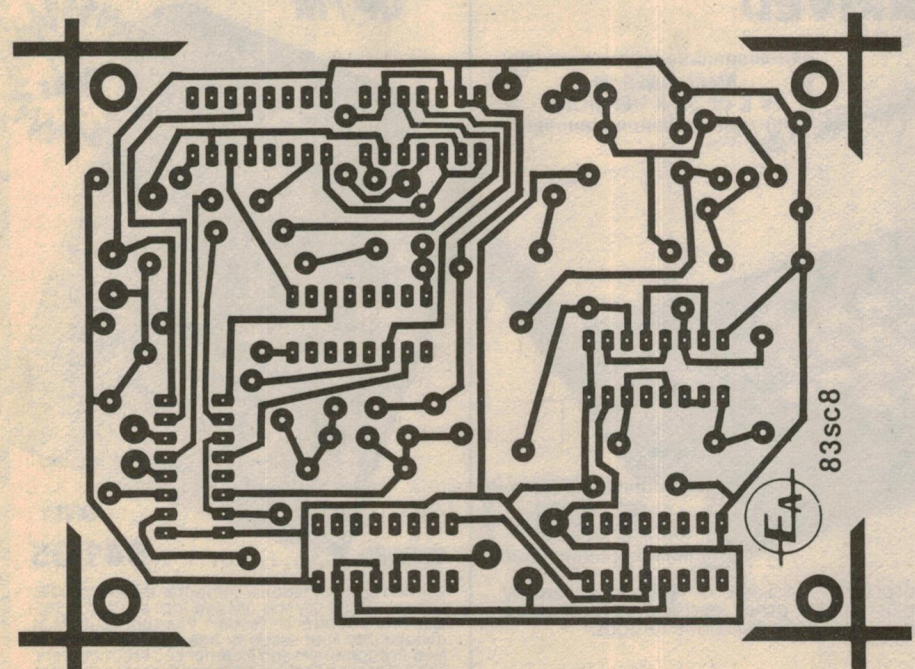
A plastic zippy case measuring 50x95x158mm is used to house the circuitry, and is fitted with a Scotchcal front panel label. Spray the label with a hard-setting lacquer (eg, Estapol), then carefully affix the label to the plastic base of the case (NOT the lid). The front-panel cutouts can now be made by drilling inside the marked lines with a small drill and then filing for a neat finish.

You will have to make three cutouts in all – one each for the range switch and the on/off switch, and one for the display. You will also have to drill mounting holes for the switches, and for the BNC input connector. The latter is mounted on the bottom right hand side of the case, as shown in the photographs.

Now for the final assembly. The two PCBs are stacked and mounted on the aluminium lid of the case using 15mm tapped spacers. Fig. 2 shows how it all goes together. Note in particular the earthed aluminium shield and the cardboard insulator directly beneath the 83sc7 display PCB.

The aluminium shield is necessary to prevent radiation from the 83sc8 module from falsely triggering the high impedance counter circuitry. Don't forget to earth the shield as shown in Fig. 2.

The PCB assembly must be accurately positioned on the lid so that, when the case is assembled, the LCD sits directly



Above is the actual-size artwork for the preamplifier/timebase PCB.

PARTS LIST

1 printed circuit board, code 83sc7, 78x102mm
1 printed circuit board, code 83sc8, 78x102mm
1 plastic utility box, 50x95x158mm
1 Scotchcal front panel label, 94x156mm
1 piece of aluminium sheet, 78x102mm
1 piece of cardboard, 78x102mm
1 battery clip
1 4-way AA battery holder
4 1.5V size AA batteries
1 DP3W slider switch (single pole used)
1 DPDT slider switch
1 watch crystal, 32.768kHz
1 BNC panel socket
1 40-pin DIL socket
1 48-pin Molex IC socket strip
1 4½-digit liquid crystal display (Dick Smith Catalog No. Z-4175 or equivalent)
4 stick-on rubber feet
8 15mm tapped brass spacers
4 20mm machine screws
4 10mm machine screws
1 earth lug

SEMICONDUCTORS
2 1N4148, 1N914 small signal diodes
1 2N5485 N-channel FET
1 74C946 or ICM7224 4½-digit counter/display driver
1 4020 14-stage ripple carry binary counter
3 4017 decade counters
1 4013 dual D-flipflop
2 4009, 4049 hex inverters

CAPACITORS
2 4.7µF/10VW PC electrolytic capacitors
2 0.47µF metallised polyester
2 0.1µF metallised polyester
1 47pF ceramic
1 10pF ceramic
1 5-30pF miniature trimmer

RESISTORS (¼W, 5%)
1 x 10MΩ, 2 x 1MΩ, 1 x 220kΩ, 1 x 10kΩ, 3 x 1kΩ, 1 x 820Ω

MISCELLANEOUS
Tinned copper wire, solder, rainbow cable and shielded cable, machine screws and nuts, etc.

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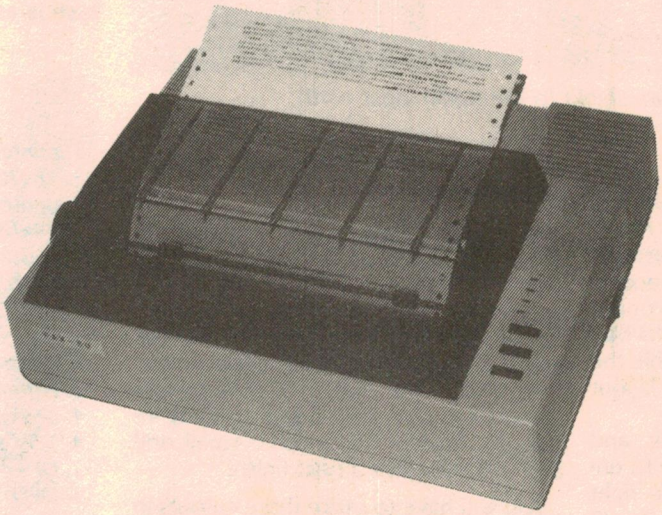

GENERAL INFORMATION

This printer is designed to operate through software control, supplied from any general purpose micro-computer, personal computer, office computer etc. that has provision of printing data out-put that should conform with this specification. It prints upper-and lower-case alpha-numeric characters in both normal and italic letter forms, and graphic characters available on the character code set of this printer beside capability of bit image graphic printing it is also functionated. Additionally, this printer has considerable formatting capability owing to its own internal microprocessor system.

Interface specifications

Interface:
Standard Centronics parallel. Optional RS-232C. (SERIAL).
Data transfer rate:
4,000 CPS max.
Synchronization:
By external supplied STROBE pulses.
Handshaking:
By ACKNLG or BUSY signals.
Logic level:
Input data and all interface control signals are TTL level.

Functional specifications

Printing method:
Serial impact dot matrix.
Printing format:
Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field.
Semi-graphic (character graphic) — 7 x 8 dot matrix.
Bit image graphic — Vertical 8 dots parallel, horizontal 640 dots serial/line.
Character size:
2.1mm (0.083")-W x 2.4mm (0.09")-H/7 x 8 dot matrix.

Character set:
228 ASCII characters; Normal and italic alpha-numeric font, symbols and semi-graphics.
Printing speed:
80 CPS, 640 dots/line per second.
Printing direction:
Normal — Bidirectional, logic seeking. Superscript and bit image graphics — Unidirectional, left to right.
Line spacing:
Normal — 4.23mm (1/6").
Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line:
Normal size — 80 columns.
Double width — 40 columns.
Compressed print — 142 columns.
Compressed/double width — 71 columns.
The above can be mixed in a line.
Paper feed:
Adjustable sprocket feed and friction feed.
Paper type:
Fanfold. Single sheet.
Paper width — 101.6mm (4") to 254mm (10").

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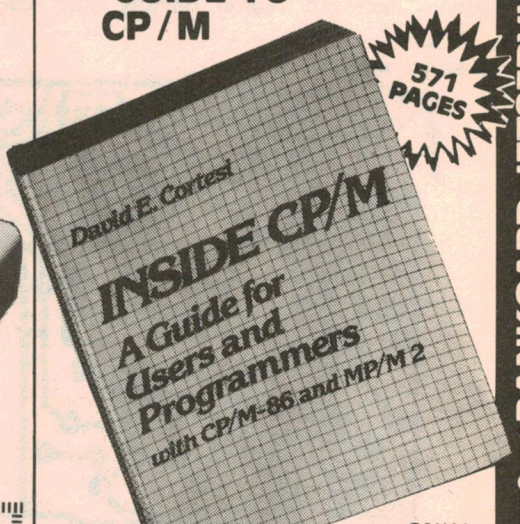
THE ULTIMATE GUIDE TO CP/M



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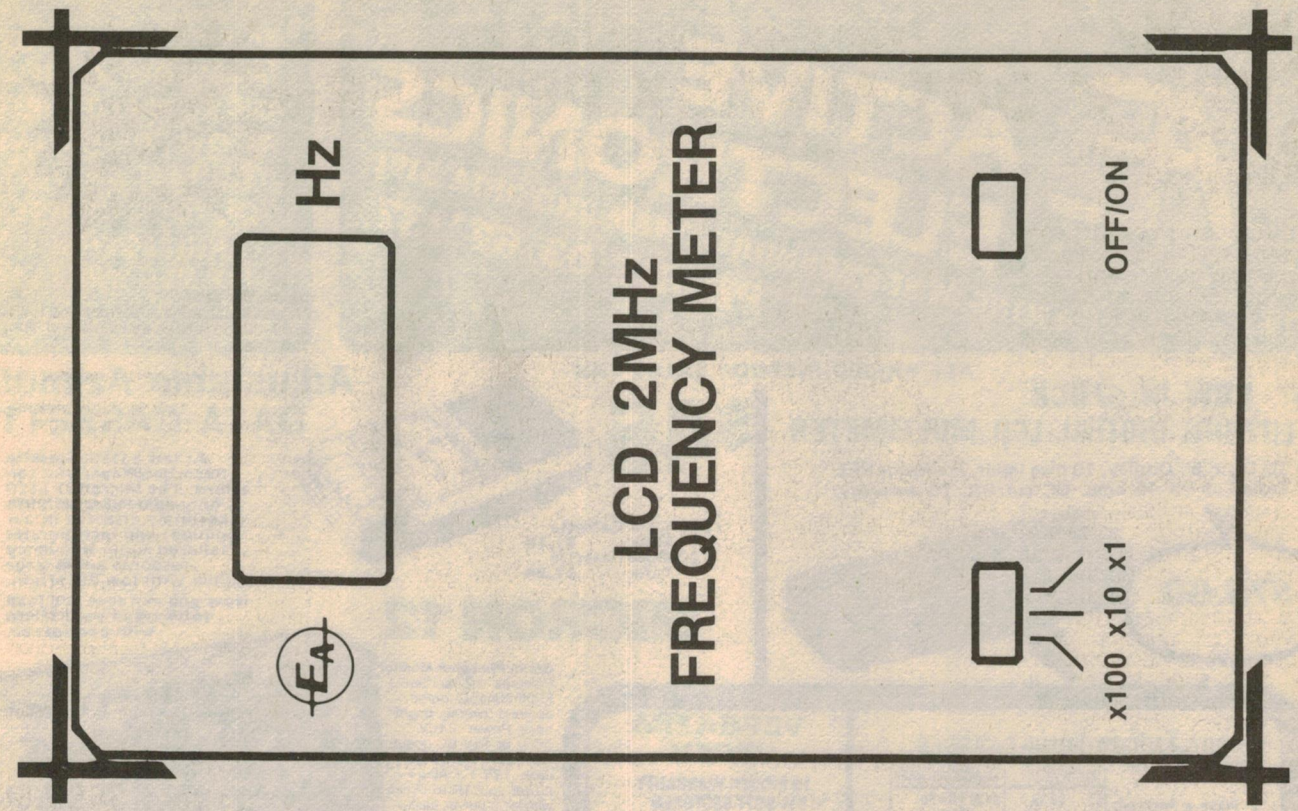
Penned by international computer expert David E. Cortesi, INSIDE CP/M is divided into a Tutorial Section and a Reference Section. The tutorial is again divided into four sections, one for Novices, Users, New Programmers and Experienced Programmers. The Reference Section is the most comprehensive we have ever seen and this book should sit proudly next to any CP/M system.
APPLICABLE TO CP/M 1.4, 2.2, 86, MP/M and MP/M 2.



Here is an actual-size reproduction of the front panel artwork.

beneath the display cutout. Drill the four mounting holes, mount the PCB assembly in position, and then complete the wiring to the switches and to the battery connector. The battery holder is a snug fit between the lid and the lower PCB.

Testing

The display should be blanked when power is first applied due to the leading zero blanking feature. To test the unit, insert a short length of tinned copper wire into the BNC input connector and select the x100 range. The display should now show a high random reading when the wire is touched, the actual reading depending upon the frequency of the noise.

We estimate that the current cost of parts for this project is approximately

$60

This includes sales tax.

The other two ranges can be checked in similar fashion.

If you have access to a signal generator, it may be used to give the DFM a final checkout. Calibration is not necessary, since the accuracy of the unit exceeds the resolution. The trimmer capacitor has been provided to allow accurate adjustment of the 1Hz output if required.

Finally, don't get caught out by the blanked display. Make sure that you always turn the unit off after use to ensure long battery life.

7400

7400	.27
7402	.25
7403	.25
7404	.33
7406	.37
7407	.37
7408	.27
7410	.29
7411	.29
7413	.35
7414	.35
7416	.41
7417	.41
7420	.25
7421	.29
7423	.32
7425	.34
7426	.32
7427	.35
7430	.25
7432	.35
7437	.39
7438	.35
7440	.29
7442	.44
7444	.89
7445	.79
7446	.64
7447	.69
7448	1.16
7451	.25
7454	.25
7470	.42
7472	.37
7473	.48
7474	.38
7475	.54
7476	.29
7483	.59
7485	.69
7486	.42
7489	3.50
7490	.49
7492	.51
7493	.49
7495	.49
7496	.59
7497	.99
74107	.34
74122	.59
74123	.47
74125	.39
74126	.57
74145	.44
74147	1.95
74148	.90
74150	1.29
74151	.45
74153	.39
74154	1.45
74155	.49
74156	.83
74157	.47
74160	1.12
74161	.65
74162	1.20
74163	.59
74164	.66
74165	.79
74166	.99
74167	2.20
74174	.59
74175	.60
74176	1.20
74177	1.10
74180	.45
74182	1.05
74184	3.50
74190	.59
74191	.99
74192	.69
74193	.79
74194	.62
74195	.52
74196	.64
74197	.63
74198	1.45
74199	1.60
74221	1.60
74251	1.35
74279	.47
74283	.69
74290	.62
74293	.85
74298	.66
74365	.83
74366	.83
74367	.83
74368	.83

74LS00

74LS00	.25
74LS01	.31
74LS02	.25
74LS03	.25
74LS04	.25
74LS05	.29
74LS08	.25
74LS10	.25
74LS11	.26
74LS12	.28
74LS13	.30
74LS14	.32
74LS20	.29
74LS21	.29
74LS26	.29
74LS27	.26
74LS30	.27
74LS32	.25
74LS33	.33
74LS37	.33
74LS38	.32
74LS40	.29
74LS42	.45
74LS47	.54
74LS48	.49
74LS49	1.50
74LS51	.25
74LS54	.27
74LS55	.28
74LS73	.32
74LS74	.35
74LS75	.44
74LS76	.44
74LS83	.49
74LS85	.41
74LS86	.31
74LS90	.45
74LS92	.55
74LS93	.44
74LS95	.54
74LS96	.79
74LS107	.44
74LS109	.38
74LS112	.39
74LS122	.59
74LS123	.61
74LS125	.40
74LS126	.53
74LS132	.45
74LS136	.32
74LS138	.45
74LS139	.48
74LS151	.47
74LS152	.55
74LS153	.45
74LS154	1.30
74LS155	.52
74LS156	.45
74LS157	.43
74LS158	.40
74LS160	.59
74LS161	.52
74LS163	56
74LS164	52
74LS165	65
74LS170	.79
74LS173	.61
74LS174	.52
74LS175	.44
74LS190	.83
74LS191	.79
74LS192	.50
74LS193	.64
74LS194	.64
74LS195	.51
74LS197	.61
74LS221	.65
74LS240	.82
74LS241	.85
74LS242	.79
74LS243	.72
74LS244	.95
74LS245	1.10
74LS248	.52
74LS249	.82
74LS251	.55
74LS253	.52
74LS257	.49
74LS258	.47
74LS259	.79
74LS266	.39
74LS273	.89
74LS279	.44
74LS283	.56
72LS290	.50
74LS293	.64
74LS298	.60
74LS352	.59
74LS365	.49
74LS366	.49
74LS367	.49
74LS368	.49
74LS373	.98
74LS374	.89
74LS375	.49
74LS377	1.10
74LS378	.52
74LS390	.69
74LS393	.70
74LS447	.72
74LS629	3.20
74LS640	1.70
74LS670	.99
81LS95	1.85
81LS96	1.85
81LS97	1.85
81LS98	1.85

74F00

74F00	.75
74F02	.75
74F04	.75
74F08	.75
74F10	.75
74F11	.75
74F20	.75
74F32	.75
74F64	.75
74F74	.85
74F86	1.10
74F109	.96
74F138	1.58
74F139	1.58
74F151	1.58
74F153	1.58
74F157	1.58
74F158	1.58
74F175	2.50
74F181	4.35
74F182	2.30
74F189	6.80
74F190	3.60
74F191	3.60
74F194	2.16
74F241	3.15
74F243	3.92
74F244	3.15
74F251	1.75
74F253	1.75
74F257	1.75
74F258	1.75
74F350	3.20
74F352	1.75
74F353	1.75
74F373	3.60
74F374	3.60
74F399	2.50
74F521	3.80
74F533	3.60
74F534	3.60

74S00

74S00	40
74S02	.47
74S03	45
74S04	.40
74S05	44
74S08	.44
74S10	44
74S11	42
74S15	59
74S20	42
74S30	47
74S32	49
74S40	50
74S51	42
74S64	45
74S74	50
74S86	58
74S112	68
74S113	78
74S132	.58
74S133	.45
74S135	1.20
74S136	2.20
74S138	.78
74S139	.88
74S140	.42
74S151	.65
74S153	.65
74S157	.80
74S158	78
74S161	4.50
74S174	.78
74S175	.85
74S188	2.80
74S189	2.85
74S194	1.50
74S242	3.95
74S253	.85
74S257	.93
74S258	99
74S283	1.60
74S287	2.50
74S288	2.40
74S289	3.10

74C00

74C00	.45
74C02	.45
74C04	.40
74C08	.40
74C10	.40
74C14	.50
74C20	.46
74C30	.44
74C32	.40
74C42	1.25
74C48	1.65
74C73	.70
74C74	.90
74C83	2.10
74C85	1.20
74C86	.35
74C89	3.70
74C90	1.40
74C93	1.40
74C95	1.50
74C107	1.05
74C150	3.40
74C151	2.90
74C154	4.65
74C157	2.60
74C160	1.30
74C161	1.05
74C162	1.25
74C163	1.20
74C164	1.50
74C165	1.65
74C173	.79
74C174	79
74C175	.90
74C192	1.55
74C193	.95
74C195	1.65
74C200	12.95
74C221	1.65
74C240	2.35
74C244	2.60
74C373	2.60
74C374	2.50
74C901	.85
74C902	.80
74C904	.77
74C906	.75
74C907	.75
74C908	1.50
74C910	12.95
74C911	11.85
74C912	12.50
74C914	2.20
74C915	1.95
74C917	12.00
74C918	1.80
74C920	5.50
74C922	5.60
74C923	5.40
74C925	7.50
74C926	7.90
74C927	6.80
74C928	8.50
74C929	4.20
74C930	4.20
74C941	2.25
74C989	8.60

4000

4000	.26
4001	.26
4002	.26
4006	.68
4007	.25
4008	.70
4009	.66
4010	.62
4011	.25
4012	25
4013	31
4014	.77
4015	.65
4016	.39
4017	.66
4018	.78
4019	.44
4020	60
4021	.79
4022	66
4023	.25
4024	56
4025	.28
4026	98
4027	.39
4028	.69
4029	.84
4030	.42
4031	3.25
4033	1.80
4034	1.80
4035	.90
4040	.65
4041	1.00
4042	.65
4043	.80
4044	.50
4046	1.05
4047	.80
4048	.46
4049	.35
4050	.39
4051	.72
4052	1.15
4053	.80
4055	2.20
4060	1.00
4063	1.10
4066	.40
4068	.28
4069	.25
4070	.25
4071	.27
4072	.26
4073	.28
4075	.26
4076	.82
4077	.30
4081	.25
4082	.28
4085	.60
4086	.45
4089	2.10
4093	.40
4094	.70
4099	1.20
4104	2.30
4160	.80
4161	1.10
4163	1.10
4174	.80
4175	80
4194	.80
4409	5.60
4411	10.50
4419	3.40
4469	13.50
4495	2.80
4500	5.80
4502	.88
4503	.68
4507	.29
4508	1.20
4510	.80
4511	.80
4512	.70
4514	1.70
4515	1.95
4516	.85
4518	.80
4519	.68
4520	.80
4521	2.00
4522	1.14
4526	1.10
4527	1.00
4528	.84
4529	1.24
4531	1.04
4532	.95
4534	6.00
4538	1.10
4539	.60
4541	1.10
4543	.94
4553	3.00
4555	.60
4556	.65
4558	1.40
4560	2.50
4569	2.10
4572	.60
4583	1.00
4584	.70
4585	.82
4599	4.20

9000

9300	.60
9302	1.10
9304	.62
9307	1.50
9308	1.90
9309	.64
9310	.88
9311	1.69
9312	.54
9314	.59
9316	.78
9318	1.40
9320	5.00
9321	.88
9322	.55
9324	.78
9328	.99
9334	1.18
9338	1.30
9340	2.85
9368	1.18
9370	.94

LINEAR ETC.

AD570	58.00
AD7524	14.20
ADC0800	14.90
ADC0804	5.50
ADC0808	12.60
ADC0809	8.00
ADC0817	13.60
ADC1210	58.00
AY-3-1015	6.50
AY-3-8910	10.00
BR1941	11.50
BR1943	12.00
CA3028	1.90
CA3036	4.50
CA3039	1.60
CA3059	4.50
CA3081	.99
CA3130	1.40
CA3130T	1.50
CA3140	.80
CA3140T	1.45
CA3146	2.20
CA3401	.99
DAC0800	3.20
DAC0808	2.50
DAC1220	12.50
DM8121	2.50
DM8130	5.20
DM8131	2.95
DM8309	.64
DM8310	.88
DM8312	.54
DM8316	.78
DS8820	1.50
DS8830	1.70
DS8833	1.90
DS8836	1.50
DS8859	2.05
DS8869	1.80
DS75107	.80
DS75108	1.20
DS75110	1.20
DS75150	1.20
DS75154	.95
DS75451	.60
DS75452	.45
DS75453	.80
DS75454	.66
FD1771	21.00
FD1791	39.00
FD1793	39.00
FD1795	35.00
ICL7106	17.50
ICL7107	18.00
ICL7660	4.80
ICM7217A	17.50
ICM7218A	18.00
ICM7555	1.60
ICM7556	2.70
L120	2.25
L121	2.60
LF347	1.95
LF351	.55
LF353	.90
LF356	1.25
LF357	1.25
LF398	3.95
LF398H	6.50
LF13741	.72
LH0002	10.95
LH00042CH	9.60
LH0070-1H	15.90
LH0071-1H	17.50
LM10CH	6.50
LM304H	2.95
LM307	.50
LM310	1.95
LM311-14	1.20
LM318	1.75
LM319	1.95
LM322	1.95
LM325	4.50
LM329	.80
LM334	1.60
LM335Z	1.50
LM336Z	1.50
LM349	1.65
LM358	.65
LM358AN	1.40
LM374	4.80
LM377	2.10
LM380-8	1.20
LM380-14	.98
LM381	1.80
LM382	1.50
LM383	1.95
LM386	.72
LM387	.80
LM394CH	3.80
LM565	.89
LM566	2.00
LM567	.90
LM1830	3.20
LM1886	6.00
LM1889	2.40
LM2917-14	2.10
LM3080	.98
LM3089	2.90
LM3524	2.98
LM3900	.49
LM3905	1.50
LM3909	1.00
LM3911	2.00
LM3914	2.95
LM3915	2.75
LM3916	2.80
LM4250	2.00
MC1350	1.38
MC1406	9.00
MC1445	3.90
MC1456	1.60
MC1466	13.50
MC1494	7.40
MC1495	7.20
MC1496	1.40
MC3340	1.40
MC3370	3.70
MC3470	9.00
MC3486	3.30
MC10116	1.40
MCM66740	16.00
MM5303	6.50
MM5837	2.50
MM58167	11.50
MN3001	16.50
MSM58372	12.50
NE530	2.30
NE558	1.90
NE571	1.90
NE5534	1.45
NE5534AN	1.85
OM321	11.00
OM335	19.50
OM350	9.50
SAB0600	6.50
SAK140	.95
SN76477	5.65
SN76488	7.40
TA7205	1.80
TCA220	8.50
TL061	1.10
TL062	1.55
TL071	.80
TL072	1.50
TL074	2.85
TL075	3.20
TL081	.60
TL082	1.20
TL084	2.35
TR1602	7.30
TR1863	6.70
TR1983	9.00
UA301	.48
UA301H	1.35
UA305H	1.25
UA308	.58
UA311	.62
UA311H	1.30
UA324	.70
UA339	.45
UA348	1.40
UA393	.52
UA555	.38
UA556	.90
UA709	.58
UA710	.75
UA711	.60
UA723	.49
UA723H	1.30
UA725	2.50
UA739	.99
UA741	.38
UA741H	1.15
UA747	.98
UA1458	.50
UA1488	.70
UA1489	.70
UA2901	.60
UA3086	.50
UA4136	1.30
UAA170	4.60
UAA180	4.60
ULN2003	1.25
WD1393	65.00
WD1691	17.50
XR2206	5.95
XR2207	5.00
XR2208	3.20
XR2211	6.90
XR2216	2.80
XR2240	3.00
XR2243	3.00
8T26	1.80
8T28	2.40
8T95	1.60
8T96	1.80
8T97	1.95
11C90	12.50
95H90	7.00

MICRO

2102	1.60
2112	7.50
2114	1.95
2532	6.75
2564	16.50
2708	5.90
2716	4.50
27128	55.00
2732	5.40
2764	9.50
2816	12.50
2911	32.00
2912	22.00
2920	108.00
4116 150NS	1.95
4164 150NS	7.50
6116P3	6.80
6502	9.45
6502A	9.80
6505	12.00
6507	8.64
6520	2.99
6522	7.90
6522A	10.80
6532	10.70
6545	19.80
6551	13.80
6800	4.90
6802	6.90
6808	4.50
6809	16.00
6810	3.20
6820	2.85
6821	2.70
6840	5.80
6844	12.50
6845	12.50
6847	7.50
6850	2.50
6852	2.70
6854	8.80
6875	10.50
68A09	29.50
68B00	6.50
68B21	3.90
68B40	7.80
68B45	16.50
68B50	3.40
68B54	12.00
8080	6.90
8085A	5.90
8086	53.00
8088	42.00
8155	5.20
8156	5.50
8185	35.00
8202A	57.00
8203	57.00
8206	117.00
8212	1.60
8214	1.80
8216	1.65
8224	4.50
8226	1.80
8228	3.50
8231	285.00
8237	42.00
8238	10.80
8243	3.00
8251A	4.90
8253	5.60
8255A	3.50
8257	6.50
8259	4.70
8271	97.00
8272	30.00
8273	59.00
8274	44.00
8275	45.00
8276	24.00
8282	8.40
8283	8.40
8284	10.40
8286	8.40
8287	8.40
8288	25.00
8289	32.00
8291A	43.00
8292	35.00
8293	25.80
Z80CPU	5.40
Z80ACPU	5.90
Z80BCPU	11.00
Z80P10	4.40
Z80AP10	5.80
Z80510	12.70
Z80A510	16.00
Z80CTC	5.30
Z80ACTC	6.50
Z80DMA	15.50
Z80ADMA	18.00
8741A	36.00
8748-8	26.00
8749	55.00
8755A	35.00

VOLT REGS

LM309H	3.90
LM317HVK	7.50
LM337T	1.20
LM337HVK	12.00
LM337K	6.50
LM338K	8.00
LM350K	6.30
LM350T	4.50
LM396K	18.90
LM79L05	.70
LM79L12	.60
LM79L15	.60
SH1605	15.00
UA317T	.85
UA317K	2.60
UA309K	1.80
UA494	3.20
UA7805	.65
UA7805K	1.65
UA7806	.75
UA7808	.65
UA7808K	1.65
UA7812	.65
UA7812K	1.65
UA7815	.65
UA7815K	1.65
UA7818	.70
UA7818K	1.70
UA7824	.65
UA7824K	1.70
UA78H05K	7.50
UA78H12K	9.20
UA78HGKC	9.80
UA78L05	.35
UA78L12	.35
UA78L15	.35
UA78M05	.60
UA78M12	.60
UA78P05K	15.70
UA78540	2.80
UA7905	.72
UA7905K	1.85
UA7908	.72
UA7908K	1.85
UA7912	.72
UA7912K	1.85
UA7915	.72
UA7915K	1.85
UA79HGKC	16.00
UA79M05	.65
UA79M12	.65

OPTO

4N25	.98
4N26	.98
4N28	.98
4N32	.98
4N33	1.30
4N35	.98
MCT6	1.40
MCT2	.95
FND357	1.60
FND500	1.45
FND507	1.60
FND800	3.50
TIL31A	2.50
TIL81	2.00
BPW50	2.00
CQY89	.60
MOC3020	2.20
MOC3021	2.60
MAN72A	1.25
MAN74A	1.25
FCD820C	.90
FCD825C	.90
FCD850C	1.20
FPT100B	1.30
MSM3914	8.50
MSM3916	8.50

LEDS

TLG123 SGS	
3mm GREEN	.16
TLR123 SGS	
3mm RED	.10
TLO123 SGS	
3mm YELLOW	.16
TLG113 SGS	
5mm GREEN	.16
TLR113 SGS	
5mm RED	.10
TLO113 SGS	
5mm YELLOW	.16
Z0160	
RECT. RED	.25
Z0162	
RECT. GREEN	.25
Z0164	
RECT. YELLOW	.25
FLS010	
5mm LED CLIP	.04

DIODES

IN4148	.03
IN914	.03
IN4001	.05
IN4002	.05
IN4004	.05
IN4007	.08
IN5404	.16
IN5408	.18
0A47	44
0A90	.18
0A202	.88
0A636	.90
P600G	
6A400V	.36
BAW62	.30
BA102	.70
0A91	.20
0A95	.25
IN3492	
25A100V	1.50
IN3492R	
25A100V	1.50
IN5060	.30

BRIDGES

VJ448	
10A400V	1.80
BR154	
15A400V	3.10
BR254	
25A400V	3.95
BR354	
35A400V	4.50
P04	
6A400V	1.25
RS204	
2A400V INLINE	.80
SB204	
2A400V	.75
W04	
1.5A400V	.40

ZENERS

IN4733A	
5.1V 1 WATT	.18
IN4734A	
5.6V 1 WATT	.18
IN4736A	
6.8V 1 WATT	.18
IN4740A	
10V 1 WATT	.18
IN4742A	
12V 1 WATT	.18
IN5349B	
12V 5 WATT	.70
BZX61/C75	
75V 1.3 WATT	.80

TRANSISTORS

AC126	.70
AC127	.60
AC128	.86
AC187	.58
AC188	1.10
AD149	1.90
AD161	1.70
AD162	1.70
AF127	.98
BC107	.30
BC107B	.35
BC108	.30
BC108C	.35
BC109	.30
BC109C	.35
BC177	.35
BC178	.35
BC179	.35
BC212	.20
BC318	.15
BC327	.15
BC328	.15
BC546	.15
BC547	.15
BC547C	.16
BC548	.15
BC548C	.16
BC549	.15
BC549C	.16
BC550	.15
BC556	.15
BC557	.15
BC557B	.16
BC558	.15
BC558B	.16
BC559	.15
BC559B	.16
BC637	.35
BC639	.30
BC640	.30
BCY70	.40
BCY71	.44
BD135	.33
BD136	.39
BD137	.40
BD138	.40
BD139	.32
BD140	.32
BD233	.40
BD235	.42
BD236	.42
BD237	.44
BD238	.44
BD262	.75
BD263	.75
BD437	.46
BD647	1.98
BD677	.62
BD681	.60
BD682	.60
BDV64B	3.10
BDV65B	3.10
BDY96	3.50
BDY97	3.50
BF115	.57
BF167	.57
BF173	.60
BF180	.80
BF184	.70
BF198	.22
BF199	.22
BF337	.50
BF458	.51
BF459	.51
BF469	.80
BF470	.80
BF494	.27
BFY50	.53
BFY90	.72
BU126	1.87
BU208	2.15
BU326A	1.92
BUX80	3.50
MFE121	1.40
MFE131	1.40
MJ413	3.40
MJ802	3.75
MJ1001	2.50
MJ15003	3.65
MJ15004	3.65
MJ2955	1.04
MJ4032	8.32
MJ4035	7.60
MJ4502	4.10
MJE340	.75
MJE350	.85
MJE251	1.25
MJE700	.51
MJE800	.51
MJE2955	1.92
MJE3055	1.76
MPSA05	.19
MPSA06	.19
MPSA12	.19
MPSA14	.19
MPSA42	.19
MPSA56	.19
MPSA92	.19
MPF102	.56
MPF103	.79
MPF105	.79
MRF237	3.90
MRF454	29.00
MRF475	4.50
MRF901	2.80
TIP31	.40
TIP31A	.45
TIP31B	.54
TIP31C	.62
TIP32	.44
TIP32A	.56
TIP32B	.58
TIP32C	.64
TIP41	.66
TIP41A	.70
TIP41B	.74
TIP41C	.76
TIP42	.60
TIP42A	.76
TIP42B	.80
TIP42C	.82
TIP111	.68
TIP112	.75
TIP116	.77
TIP117	.83
TIP120	.66
TIP122	.72
TIP125	.77
TIP127	.96
TIP2955	1.20
TIP3055	1.20
2N301	3.90
2N697	.42
2N918	.42
2N2219	.42
2N2219A	.48
2N2222	.42
2N2222A	.48
2N2369	.42
2N2484	.42
2N2646	.96
2N2647	1.60
2N2894	.36
2N2904	.45
2N2905	.45
2N2905A	.49
2N2906	.40
2N2907	.42
2N2907A	.49
2N3019	.46
2N3053	.46
2N3054	1.74
2N3055	.89
2N3302	.39
2N3440	.80
2N3441	2.50
2N3442	2.30
2N3563	.18
2N3564	.18
2N3565	.18
2N3566	.18
2N3567	.18
2N3568	.18
2N3569	.18
2N3638	.18
2N3640	.18
2N3641	.18
2N3642	.18
2N3643	.18
2N3644	.18
2N3646	.18
2N3702	.27
2N3704	.25
2N3771	3.20
2N3772	3.60
2N3773	4.30
2N3819	.60
2N3866	.86
2N3904	.20
2N3906	.20
2N4032	.46
2N4033	.70
2N4036	.49
2N4121	.20
2N4236	1.30
2N4237	1.10
2N4250	.19
2N4258	.22
2N4355	.19
2N4356	.19
2N4360	.50
2N4401	.18
2N4402	.18
2N4403	.18
2N4416	1.40
2N4427	.80
2N5088	.18
2N5089	.20
2N5179	1.20
2N5190	.72
2N5191	.74
2N5192	.61
2N5193	.61
2N5195	.65
2N5210	.19
2N5245	.70
2N5303	3.65
2N5401	.20
2N5457	.55
2N5458	.55
2N5459	.60
2N5461	.66
2N5485	.55
2N5486	.55
2N5590	16.00
2N5591	17.00
2N5770	.19
2N5777	.96
2N5873	1.35
2N5944	14.50
2N5946	19.50
2N5961	.19
2N6027	.55
2N6084	22.00
2N6121	.62
2N6122	.60
2N6123	.52
2N6124	.60
2N6125	.66
2N6126	.58
2N6129	1.20
2N6130	1.40
2N6131	1.50
2N6133	1.60
2N696	.90
2N918	.45
25A683	.70
2SC1017	2.60
2SC1061	.70
2SC1096	.72
2SC1106	4.80
2SC1226	.95
2SC1306	1.50
2SC945A	.25
2SD350A	2.25
2SJ49	6.20
2SK134	6.20
3N201	1.80

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C106D	.80
C122D	1.60
C122E	2.00
C230D	5.90
Q4010L4	1.90
Q4015L5	2.70
Q6010L5	3.20
Q6015L5	3.50
Q6025H	9.80
S4015L5	2.20
S4025H	8.20
SC141D	1.30
SC146D	1.65
SC151D	2.20
ST2	.55
ST4	.65

TANTALUM

1UF/35V	.19
.22UF/35V	.19
.33UF/35V	.19
.47UF/35V	.19
1UF/35V	.20
1.5UF/35V	.20
2.2UF/35V	.22
3.3UF/35V	.23
4.7UF/35V	.41
10UF/35V	.55

ELECTRO PCB

1UF/50V	.15
2.2UF/25V	.15
4.7UF/25V	.15
10UF/25V	.15
33UF/25V	.15
47UF/25V	.15
100UF/25V	.16
220UF/25V	.20
330UF/25V	.25
470UF/25V	.35
1000UF/16V	.40
1000UF/25V	.50
2200UF/25V	.85

ELECTRO AXIAL

.47UF/63V	.19
1UF/63V	.19
2.2UF/63V	.19
3.3UF/25V	.19
4.7UF/25V	.19
10UF/160V	.25
10UF/16V	.19
10UF/25V	.19
10UF/63V	.20
22UF/25V	.20
22UF/63V	.20
47UF/16V	.19
47UF/25V	.19
47UF/63V	.20
100UF/25V	.20
100UF/63V	.35
220UF/16V	.20
220UF/25V	.25
220UF/63V	.50
470UF/16V	.39
470UF/25V	.42
470UF/63V	.65
1000UF/16V	.45
1000UF/25V	.52
1000UF/35V	.75
2500UF/16V	.88
2500UF/25V	.98
2500UF/35V	1.60
2500UF/50V	1.98
4700UF/35V	2.50

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4000UF/75V	5.80
5600UF/40V	3.80
8000UF/75V	8.95

ELECTRO BIPOLAR

2.2UF/50V	.35
4.7UF/50V	.38
6.8UF/50V	.39
10UF/50V	.40
22UF/50V	.42

GREENCAPS

.001UF/100V	.12
.0015UF/100V	.12
.0022UF/100V	.12
.0033UF/100V	.12
.0039UF/100V	.12
.0047UF/100V	.12
.0056UF/100V	.12
.0068UF/100V	.12
.0082UF/100V	.12
.01UF/100V	.12
.015UF/100V	.12
.022UF/100V	.12
.033UF/100V	.12
.039UF/100V	.12
.047UF/100V	.14
.056UF/100V	.14
.068UF/100V	.18
.082UF/100V	.18
.1UF/100V	.18
.15UF/100V	.18
.22UF/100V	.18
.27UF/100V	.22
.33UF/100V	.30
.47UF/100V	.34
1UF/250V	.85
2.2UF/250V	1.25
3.3UF/250V	2.30
4.7UF/250V	2.80
6.8UF250V	4.40
10UF/250V	5.90

GREENCAPS HIGH VOLTAGE

.01UF/630V	.22
.022UF/630V	.24
.033UF/630V	.26
.047UF/630V	.30
.1UF/630V	.38
.22UF/630V	.45
.33UF/630V	.46
.47UF/630V	.50

CERAMIC

1PF	.08
1.5PF	.08
2.2PF	.08
2.7PF	.08
3.3PF	.08
3.9PF	.08
4.7PF	.08
5.6PF	.08
6.8PF	.08
8.2PF	.08
10PF	.08
12PF	.08
15PF	.08
18PF	.08
22PF	.08
27PF	.08
33PF	.08
39PF	.08
47PF	.08
56PF	.08
68PF	.08
82PF	.08

STYROSEAL

56PF/630V	.25
68PF/630V	.25
82PF/630V	.25
100PF/630V	.25
120PF/630V	.25
150PF/630V	.25
180PF/630V	.25
220PF/630V	.25

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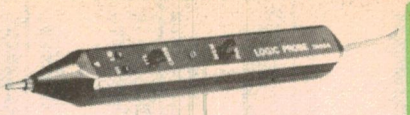

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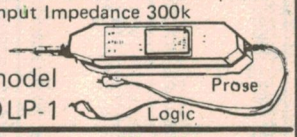

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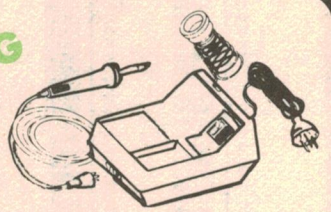

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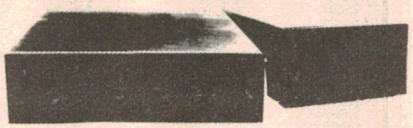

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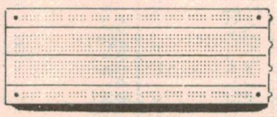

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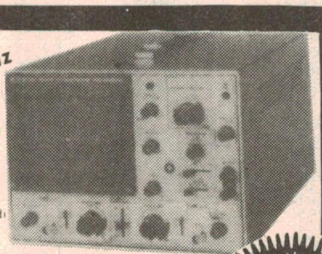

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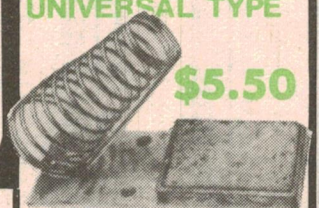

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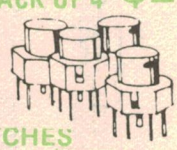

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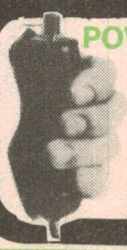

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Super-80 Baudot teleprinter interface

Want to interface your Super-80 computer to a low-cost teleprinter? Surplus Baudot teleprinters can usually be obtained for about $200 and the interface circuitry is not difficult.

by R. W. PITCHER, VK5AN

There are two types of teleprinter available to the hobbyist. Computer teleprinters such as the well-known Teletype model ASR-33 are most commonly used in business applications. These machines communicate via a 20mA current loop, at a rate of 110 baud (bits per second) and in the ASCII code.

While machines of this sort occasionally appear on the second-hand market, they are not cheap, usually ranging from $600 up depending on condition. This is rather a lot to pay to communicate with a computer costing around $400!

In contrast with these computer-type teleprinters, large supplies of the older Baudot-type teleprinters are currently available at much lower cost from companies dealing in surplus equipment. Prices for the Teletype model 15 teleprinter, for example, are around $200.

While the price is attractive compared with the more modern ASCII teleprinters, these machines are not directly compatible with computer systems, chiefly because they use a 5-bit Baudot code rather than the 7-bit ASCII code. While the code translation can be performed by software, not all ASCII characters have a Baudot equivalent.

The original program was written to make extra use of the Baudot printer I use for radioteletype, and so prints characters out at 45.45 baud. Machines currently available run at around 50 to 75 baud unless they have been converted. To change the character printing speed it is only necessary to change the byte at location 30DA hex in the listing given here. For 50 baud operation, insert 13 (hex) and for 75 baud the figure should be 0B (hex).

These figures should be considered as a guide only, as they have not been tried with a printer but were arrived at by checking the length of the mark and space pulses at the output port.

Newer teletypes run around 110 baud, with 11 bits per character, to give an effective printing speed of around 10 characters per second. In contrast Baudot machines running at 50 baud and using 7.5 bits per character provide a maximum printing speed of around 6.5 characters per second.

In fact, because of the necessity to send special "letters" and "figures" characters interspersed with actual printing characters, the maximum rate of a 50 baud Baudot teleprinter is in practice around five characters per second.

The limitations in the character set will only be of concern when printing Basic programs. For assembly language or hex listings the range is quite adequate.

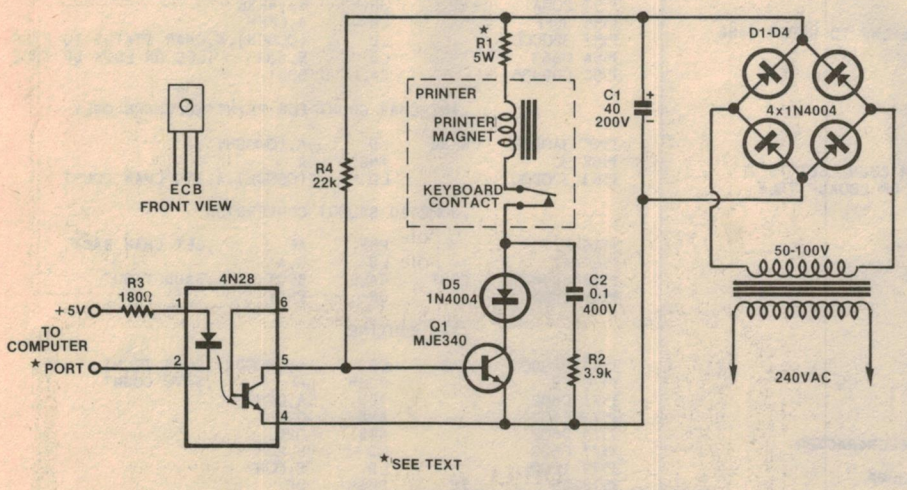


Fig. 1 LOOP SUPPLY AND COMPUTER INTERFACE

To use a teleprinter as a dedicated computer peripheral a loop supply is required. Optoisolators are used for safety and to avoid ground loops.

The program

The program uses bit 4 of output port F0 of the Super 80. A connection can be found on the underside of the board, running from pin 12 of U18. On the area marked "port" on the board, near the cassette relay, this connection is the fourth hole counting from the end marked "1".

The required software is not straightforward. The Baudot code is best considered as a 6-bit code in which the normal sixth bit is sent only when it changes value. It is sent in encoded form as a special "letters" and "figures" character shift.

To initialise the printer routine, call 3500H (CD 00 35) in the program supplying the character to be printed, or enter G3500 before using. The character to be printed is passed in the C register, and is entered at 3508H (CD 08 35). All registers are preserved by the routine.

Figures and letters shifts are inserted automatically as required, and a line feed is inserted following every carriage return. A "tab" function is included, but any other control characters are ignored, since there are no Baudot equivalents.

Lower case ASCII characters are printed as their upper case equivalent, since there are no lower case letters on

the Baudot machine. Items on the look-up table given as C0H are those with no Baudot equivalent and could be changed to print any desired character.

For instance, if you wish square brackets ([ ]) to print as normal brackets, then change location 3121H to E4H and 3124H to DEH. Any coding left as C0H sends a blank to the machine and so prints nothing.

While a character is being sent to the printer the VDU is blanked to maintain timing accuracy, so the screen is only active while the printer routine is waiting for a character. Therefore the VDU will flicker at a rate depending on the rate at which characters are fed in. If the rate is fast enough the screen appears to remain blank.

Interface circuitry

The printer will require a loop supply. If it is to be used only for program dumping, then the circuit of Fig. 1 is required. It has been found that most machines operate best with a minimum loop supply of about 70 volts, making input waveform distortion and timing errors less critical. The value of R1 is adjusted for the manufacturer's recommended loop current on "mark", (usually between 40 and 50 mA).

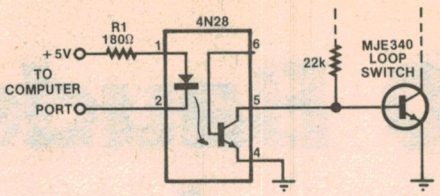


FIG. 2 INTERFACE TO SUIT RTTY TERMINAL UNIT

Circuit for use with an RTTY teleprinter.

An alternative circuit is given in Fig. 2 for those who already have an operating machine used for RTTY. In both cases, optoisolators are used to remove the risk of earth loop problems and to ensure complete isolation between the computer and any circuitry operating at high voltage.

To use the program for Basic LPRINT or LLIST, insert the following bytes from 0000H onwards:

0000H 55 4F CD 08 35 41 CD 19 C0 78 C9. Then G3500, return to Basic warmstart (GD003) and type LLIST or RUN for LPRINT. To disable the printer, change the byte at 0000H to anything but 55H. The monitor uses this routine to find out if a printer program is available and, if so, where it is located in memory.

The program has proved its worth since I can now keep a permanant record of my programs without having to copy them from the screen with its attendant risk of errors. The print out of the program accompanying this article was obtained using the same program.

Finding a teleprinter

The following companies handle second-hand computer equipment in Sydney; The Computer Exchange, 5/8 Pacific Parade, Dee Why, NSW, 2099 (02) 98 8111; CQ Electronics, Shop 9, 30 Campbell St, Blacktown, NSW (02) 698 8079.

Note that the availability of equipment is variable and depends on companies and government departments disposing of surplus equipment. It is not simply a matter of purchasing "off the shelf".

In Sydney, "The Trading Post" weekly paper often carries advertisements from individuals wishing to dispose of surplus equipment. It is a good place to start looking for a teleprinter.

The notice boards at electronics stores and computer clubs also occasionally display "FOR SALE" bulletins for teleprinters. You can also, of course, go "straight to the horse's mouth" as it were, and attend government auctions.

```
                ;45.45 BAUD PRINTER ROUTINE FOR SUPER 80
                ;COPYRIGHT 1983, R.W.PITCHER VK5AN
                ;

3500                    ORG     3500H

3500 F5         STRT    PUSH    AF          ;SAVE REGISTERS
3501 E5                 PUSH    HL
3502 C5                 PUSH    BC
3503 D5                 PUSH    DE

3504 3EFB               LD      A,0FBH
3506 D3F0               OUT     (0F0H),A    ;TURN VDU OFF

3508 79                 LD      A,C
3509 E67F               AND     7FH         ;SET BIT 7 TO ZERO

350B FE60               CP      60H
350D 3802               JR      C,CR
350F D620               SUB     20H         ;SETS LWR TO UPPER CASE

                ;CR/LF ROUTINE


3511 FE0D       CR      CP      0DH
3513 2011               JR      NZ,TCOM
3515 3E00               LD      A,00H
3517 320D00             LD      (000DH),A,CHAR COUNT SET TO Z
351A 0660               LD      B,60H       ;LOC ON LOOKUP TBLE
351C CD9835             CALL    BOUT
351F 0661               LD      B,61H
3521 CD9835             CALL    BOUT
3524 1869               JR      ENDT
3526 FE09       TCOM    CP      09H
3528 2843               JR      Z,TAB
352A FE20               CP      20H
352C 0620               LD      B,20H
352E 2838               JR      Z,COUT

                ;BYPASS FOR CONTROL CHARACTER

3530 385D               JR      C,ENDT

3532 F5                 PUSH    AF          ;SAVE CHARACTER

                ;IF FIGS OR PUNCTUATION THEN JUMP

3533 FE41               CP      41H
3535 3817               JR      C,FIGS
3537 FE5B               CP      5BH
3539 3013               JR      NC,FIGS

                ;IF LAST CHAR FIGS,SEND LTRS FIRST

353B 3A0C00             LD      A,(000CH),CHAR STATUS
353E FE00               CP      00H         ;LAST CHAR LTRS?
3540 281D               JR      Z,RESC
3542 3E00               LD      A,00H
3544 320C00             LD      (000CH),A,CHAR STATUS TO LTRS
3547 0662               LD      B,62H


3549 CD9835             CALL    BOUT
354C 1811               JR      RESC

                ;IF LAST CHAR LTRS,SEND FIGS FIRST

354E 3A0C00     FIGS    LD      A,(000CH)
3551 FE00               CP      00H         ;LAST CHAR LTRS?
3553 200A               JR      NZ,RESC
3555 3EFF               LD      A,0FFH
3557 320C00             LD      (000CH),A,CHAR STATUS TO FIGS
355A 0663               LD      B,63H       ;LOC ON LOOK UP TBLE
355C CD9835             CALL    BOUT

                ;INC CHAR COUNT FOR PRINTING CHARS ONLY

355F 3A0D00     RESC    LD      A,(000DH)
3562 3C                 INC     A
3563 320D00             LD      (000DH),A,INC CHAR COUNT

                ;JUMP TO BAUDOT CONVERSION

3566 F1                 POP     AF          ;GET CHAR BACK
3567 47                 LD      B,A
3568 CD9835     COUT    CALL    BOUT        ;BAUDOT OUT
356B 1822               JR      ENDT

                ;TAB ROUTINE

356D 3A0D00     TAB     LD      A,(000DH),CHAR COUNT
3570 F5                 PUSH    AF          ;SAVE COUNT
3571 C602               ADD     A,02H
3573 E607               AND     07H
3575 D602               SUB     02H
3577 0620               LD      B,20H
3579 1E00               LD      E,00H
357B D5         TC      PUSH    DE
357C C5                 PUSH    BC
357D F5                 PUSH    AF
357E CD9835             CALL    BOUT
3581 F1                 POP     AF
3582 C1                 POP     BC
```

```
3583 D1              POP     DE
3584 1C              INC     E          ,COUNT SPACES
3585 3C              INC     A
3586 FE08            CP      08H
3588 20F1            JR      NZ,TC      ,JP TO TAB COUNT
358A F1              POP     AF         ,GET BACK COUNT
358B 83              ADD     A,E
358C 320D00          LD      (000DH),A,UPDATE CHAR COUNT
358F 3EFF      ENDT  LD      A,0FFH
3591 D3F0            OUT     (0F0H),A ,TURN VDU ON

               ,BACK TO MAIN PROGRAMME

3593 D1              POP     DE         ,RESTORE REGISTERS
3594 C1              POP     BC
3595 E1              POP     HL


3596 F1              POP     AF
3597 C9              RET

               ,GET BAUDOT EQU FROM LOOK-UP TABLE

3598 219E35    BOUT  LD      HL,LKUP-20H
359B 1600            LD      D,00H
359D 58              LD      E,B
359E 19              ADD     HL,DE      ,LOC ON LOOKUP TBLE
359F 56              LD      D,(HL)

               ,GENERATE 8 PULSES DET BY BITS IN D REG

35A0 0608            LD      B,08H      ,NUMBER OF BITS
35A2 C5        BITS  PUSH    BC         ,SAVE BIT COUNT
35A3 CB42            BIT     0,D
35A5 2004            JR      NZ,XX
35A7 3EEB            LD      A,0EBH     ,SET O/P PORT LOW
35A9 1802            JR      YY
35AB 3EFB      XX    LD      A,0FBH     ,SET O/P PORT HIGH
35AD D3F0      YY    OUT     (0F0H),A ,SET PORT

               ,LENGTH OF PULSE FOR BAUDOT SPEED

35AF 3E86            LD      A,86H      ,DELAY TO SET SPEED
35B1 0616      PD    LD      B,16H
35B3 10FE            DJNZ    $-0        ,JUMP BACK TO YOURSELF
35B5 3D              DEC     A
35B6 20F9            JR      NZ,PD

35B8 C1              POP     BC         ,RESTORE BIT COUNT
35B9 CB3A            SRL     D          ,MOVE IN NEXT BIT
35BB 10E5            DJNZ    BITS       ,KEEP GOING FOR 8 BITS
35BD C9              RET

               ,LOOK-UP TABLE

35BE C0C0      LKUP  DEFW    0C0C0H     ,(SP)
35C0 CAC0            DEFW    0C0CAH     ,' £
35C2 F4DA            DEFW    0DAF4H     ,$ ⅘
35C4 C0CA            DEFW    0CAC0H     ,$ '
35C6 0EE4            DEFW    0E40EH     ,( )
35C8 D2E2            DEFW    0E2D2H     ,⊕ +
35CA D8C6            DEFW    0C6D8H     ,, -
35CC F8FA            DEFW    0FAF8H     ,. /
35CE ECEE            DEFW    0EEECH     ,0 1
35D0 E6C2            DEFW    0C2E6H     ,2 3
35D2 D4E0            DEFW    0E0D4H     ,4 5
35D4 EACE            DEFW    0CEEAH     ,6 7
35D6 CCF0            DEFW    0F0CCH     ,8 9
35D8 DCDC            DEFW    0DCDCH     ,: :
35DA E4FC            DEFW    0FCE4H     ,( =
35DC DEF2            DEFW    0F2DEH     ,) ?
35DE C0C6            DEFW    0C6C0H     ,  A
35E0 F2DC            DEFW    0DCF2H     ,B C
35E2 D2C2            DEFW    0C2D2H     ,D E
35E4 DAF4            DEFW    0F4DAH     ,F G

35E6 E8CC            DEFW    0CCE8H     ,H I
35E8 D6DE            DEFW    0DED6H     ,J K
35EA E4F8            DEFW    0F8E4H     ,L M
35EC D8F0            DEFW    0F0D8H     ,N O
35EE ECEE            DEFW    0EEECH     ,P Q
35F0 D4CA            DEFW    0CAD4H     ,R S
35F2 E0CE            DEFW    0CEE0H     ,T U
35F4 FCE6            DEFW    0E6FCH     ,V W
35F6 FAEA            DEFW    0EAFAH     ,X Y
35F8 E2C0            DEFW    0C0E2H     ,Z (
35FA C0C0            DEFW    0C0C0H     ,  )
35FC C0C0            DEFW    0C0C0H     ,: (DEL)
35FE D0C4            DEFW    0C4D0H     ,(CR,LF)
3600 FEF6            DEFW    0F6FEH     ,(LTRS)(FIGS)

3602                 END
```

STRT	3500
CR	3511
TCOM	3526
FIGS	354E
RESC	355F
COUT	3568
TAB	356D
TC	357B
ENDT	358F
BOUT	3598
BITS	35A2
XX	35AB
YY	35AD
PD	35B1
LKUP	35BE

Make music with your computer

Our Compumuse project is easy to build and simple to use. It connects to any computer with a Centronics-style parallel port and provides music over a five octave range and a wide variety of sound effects. Your computer programs may never be the same again!

by PETER VERNON

Programmed performance of music by computers has many practical uses apart from the satisfaction of coding the score and hearing the results. Music education using computer-assisted programs is an effective way of learning musical notation, for example.

Sound effects are also a big aspect of computer games, as any "Space Invaders" addict will tell you. Those who have game programs that run without sound will also tell you that it's just not the same in silence.

Audible feedback can also be used effectively in other programs, to signal the acceptance of data or indicate an error, or to alert the operator that some task has been completed.

Many small computers have some form of audio output, even if it is only a single bit driving an amplifier. This approach leaves much to be desired, however. Using this system the processor is fully occupied producing sound and simultaneous sound and movement of graphics images, for example, is impossible.

What is needed is a low-cost sound generator capable of music and a wide variety of sound effects for games. It should be as musically accurate as possible, and preferably be able to be used with any computer system. We think our "Compumuse" unit fits the bill.

How it works

Our circuit is based on the Texas Instruments SN76489AN sound generator IC, which contains three independently programmable frequency generators, a noise generator and a programmable attenuator for each sound source. The outputs of the four attenuators are summed to provide a single audio output (see Fig.1).

Each of the three tone generators of the chip contains a 10-bit programmable counter used as a frequency divider. The output frequency of each generator is determined by the value loaded into the 10-bit register and the overall clock frequency of the sound chip.

Once loaded the register is decremented at a rate of N/16, where N is the chip clock frequency. When the register value reaches zero the frequency flipflop is toggled and the counter reloaded with the original value. Since the output flipflop must be toggled twice to produce a square wave pulse the counter value specifies half the period of the waveform.

The frequency produced for any counter value, R0, can thus be calculated with the formula:

F0 = N/(32*R0).....equation 1

where N is the clock frequency.

The maximum number that can be repesented in 10 bits is 1023, but the SN76489AN will interpret a zero value as 1024, using "one's complement" arithmetic. The first count decrements 0 to give a result of 1023. Effectively then, 0 represents 1024 and the maximum amount we can divide the clock frequency by is 32 × 1024 or 32,768.

With a 2MHz clock frequency the lowest tone that can be produced is therefore:

2,000,000/(32*1024) = 61.03Hz

and the highest tone available is;

2,000,000/(32*1) = 62,500Hz

Since the register value must be an integer, some frequencies cannot be produced exactly. An exact 440Hz note (A above middle C) for example, requires a divider value of R0, where;

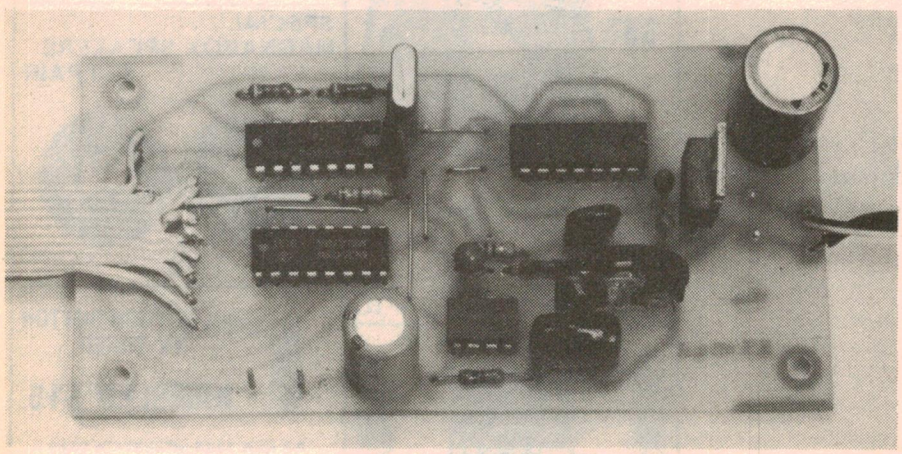
R0 = 2MHz/(32*440).....equation 2

which is equal to 142.045

Taking the integer value of R0 and substituting it back into equation 1 gives us the actual frequency which will be produced;

F0 = 2,000,000/(32*142) = 440.14Hz

This represents an error of about .035%.



The circuit has three programmable tone sources and a noise generator.

Each of the tone output flipflops is fed into a four stage attenuator. Depending on the setting of the control byte the attentuation stages provide attenuation from 0dB to 30dB (off) in 2dB steps, allowing control of the envelope of each tone produced.

The noise source consists of a shift register with an exclusive-OR feedback network. If the feedback network is enabled the shift register produces white noise. A repeating pattern, sounding like a low tone, is produced if the feedback network is disabled.

The output of the noise source is also fed to a programmable attenuator, allowing the volume of the noise to be controlled in the same way as the volume of the tone sources.

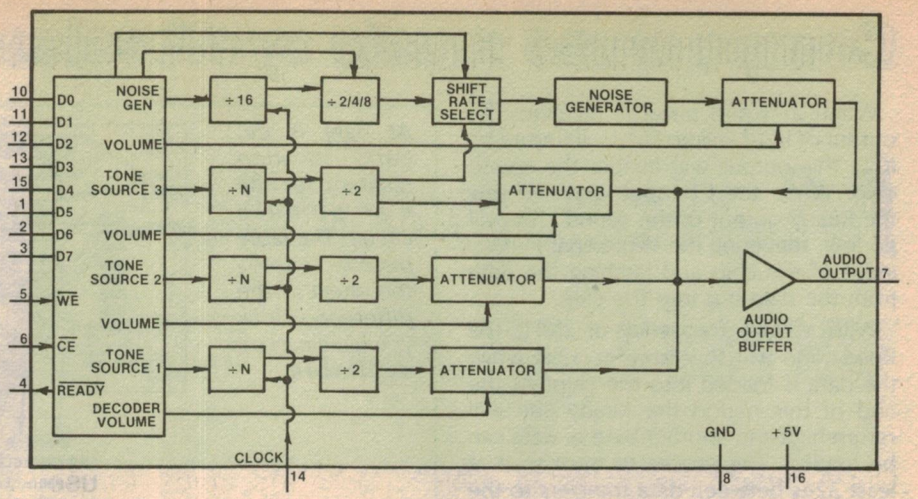


Fig. 1

This block diagram of the Texas Instruments SN76489AN sound generator chip shows the separate divider circuits and attentuators for each of three tone sources and noise. Full circuit diagram is shown below.

The circuit

While it is possible to connect the SN76489AN directly to the microprocessor data bus, such a circuit would be dependent on the actual computer system used with the sound generator. The circuit shown in Fig. 2 is designed to be connected to a Centronics-style parallel interface, and can be used with any computer that has a latched parallel output port with a strobe output and a Ready signal input.

These include the System-80 and TRS–80 with expansion units, the Super-80 fitted with a parallel interface board and the MicroBee computer, among others.

The maximum clock frequency of the SN76489AN is 4MHz, but since the range (and to a lesser extent, the accuracy) of the sound generator is determined by the clock frequency, we have made provision for users to select one of three clock frequencies, as summarised in Fig. 3.

The 4MHz clock frequency limits the range in the lower octaves while providing an extended range in the (useless) ultrasonic regions. In some cases though, particular frequencies can be more closely approximated with a 4MHz clock.

Our prototype used a 2MHz clock, which provides a usable range of five octaves with acceptable accuracy and data load time. A 1MHz clock provides a six octave range, but accuracy tends to fall off.

All clock frequencies are generated by a 4MHz crystal in conjunction with the two NAND gates of IC1. Depending on which of the links shown on the component overlay are installed, the 4MHz clock will be fed directly to the SN76489AN or passed through either one or both flipflops of IC2.

Connection to host computer

The computer loads a byte of data to the sound chip by putting it on the data lines and pulsing the Strobe input line low. The input data must remain stable for 32 clock cycles (32μs at 2MHz) to allow time for the chip to latch it.

Centronics ports such as those used by the Super-80, System-80 and TRS-80 produce the strobe pulse automatically when the address of the printer port is selected. Users of other computers will need to make other arrangements.

On the Sorcerer for instance, a "Data Available" signal appears on pin 3 of the parallel port connector when data is written to the output port FF. This signal will remain low until reset by a low-going signal on pin 2 of the parallel connector. The Ready output of the sound generator board can be used as a "data received" signal in this case.

The low-going Strobe signal is input to NAND gate IC1d. Before the Strobe line is activated both inputs to IC1d (pins 12 and 13) will be high, and the output (pin 11) will be low. This output is inverted by IC1c, placing a "1" on the CE input and disabling the sound chip.

Compumuse music synthesiser

When a Strobe pulse is received the output of IC1d will go to "1". Inverted by IC1c this output will enable the sound chip. When the CE input is pulled low the Ready output of the sound chip will go low, triggering the Write Enable (WE) input of the chip and latching the data from the data bus into the chip.

With a clock frequency of 2MHz the Ready line will stay low for 32μs while the data is loaded into the chip. At the end of this period the Ready line will return high and another byte of data can be loaded. The processor must wait at least 32μs between data transfers to the sound generator.

Using Basic this timing does not pose a problem. Most Basic interpreters take several milliseconds to execute an OUT statement. For some sound routines, however, Basic may be too slow in updating the sound generator registers and a machine language program must be used.

For use with machine language driver routines a Ready signal is brought off the board for connection to the processor through the Busy input of a Centronics port. By monitoring the Ready signal and transferring data when this line goes high, correct data input timing will be automatic.

The sound generator's output buffer produces a signal with a voltage swing of about 2V. A simple audio amplifier based on the LM386 provides more than enough power to drive a loudspeaker. A 10kΩ trimpot is used as an overall volume control, and a Zobel network (.033μF and 22Ω) on the output of the sound generator is used to prevent oscillation of the sound chip output buffer.

The circuit requires a single +5V supply, provided by a 9V DC plugpack feeding a +5V regulator on the sound generator board. Since 9V is a "normal" rating only, the 5V regulator may be called upon to dissipate considerable power. A flag type heatsink can be added if the regulator tends to run hot. Current consumption of the circuit is less than 200mA.

Construction

Start construction with the power supply, ensuring that the regulator and tantalum and electrolytic capacitors are installed with the correct orientation, as shown on the component overlay diagram.

Before proceeding connect the plugpack and test the output of the regulator. If all is well disconnect the power and proceed to the next stage of construction.

The 4MHz crystal, resistors and capacitors can be installed, followed by the ICs. None of the integrated circuits used in this project are particularly sensitive, but be careful not to subject them to too much heat when soldering. 300°C for 10 seconds is the normal maximum soldering specification, but a good joint can be made in much less time.

Depending on which clock frequency is required, install the link options.

The sound generator is connected to the printer port of the System-80 or Super-80 by a 34-way edge connector and a length of ribbon cable. Strictly speaking it is not necessary to connect the Ready output to the computer if you will only be using Basic to control the synthesiser, but it's just as easy to make a complete job of it the first time.

Connect the loudspeaker and set the volume control to about half-way. Without connecting the sound generator to the computer, connect the power and switch on. You should be rewarded by a tone from the speaker. As no register values have been set, the tone will be a random mixture of the outputs of the three frequency generators and noise. Turn off the sound generator after this test.

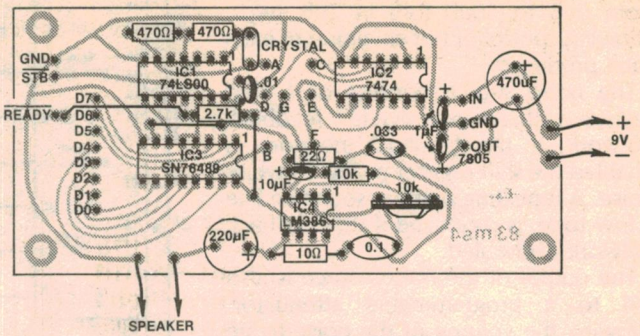
With the computer and all peripherals off connect the sound generator to the computer. As with all computer systems, peripherals (including the sound generator) should be turned on before the computer itself, and turned off after the computer has been switched off.

Data formats

The SN76489AN contains eight 8-bit registers to control the tone and noise generators and attenuators. Noise and attenuation values are single bytes, while the frequency produced by the tone source is specified as two bytes.

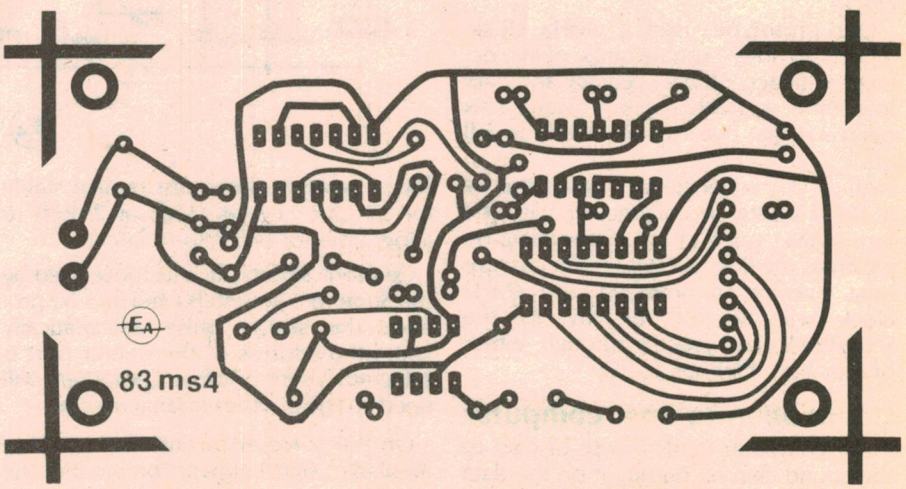
All first byte or single byte data has the most significant bit set to "1". The se-

At right is the parts location diagram for the Compumuse circuit. The table below shows the effect of the different clock frequencies available.



FOR 4MHz CLOCK LINK A-B AND DO NOT INSTALL IC2
FOR 2MHz CLOCK LINK A-C, B-D AND E-G INSTALL IC2
FOR 1MHz CLOCK LINK A-C, B-F AND D-E INSTALL IC2

Clock Frequency	Highest tone	Lowest tone
4MHz	125kHz	122.07Hz
2MHz	62.5kHz	61.03Hz
1MHz	31.25kHz	30.58Hz



Above is the full-size pattern for the Compumuse printed circuit board.

cond byte of a frequency value has the most significant bit "0".

Understanding how the SN76489AN is programmed is complicated by the fact that Texas Instruments uses a different method of numbering binary values. TI designates the most significant bit of a binary value d0, and the least significant as d7, the exact opposite of the usual scheme. We will ignore TI's "standard" and present all binary values with the most significant bit (the leftmost bit) as d7 and the least significant bit as d0.

Confusion can arise when comparing TI publications with the information given here unless this point is kept in mind.

The first byte of a two byte frequency value has a MSB (most significant bit) of "1", followed by a 3-bit register address field which determines which register receives the information which follows. The four least significant bits of the 10-bit register value are stored in bits 3 to 0 of the first byte, with the six most significant bits stored in bits 5 to 0 of the second byte. Bit 7 of the second byte is "0", and bit 6 is "don't care" (either "1" or "0").

Programming noise requires only a single byte parameter. The MSB is "1", again followed by a 3-bit address field. Bit 3 is "don't care", and bit 2 is the feedback bit. When this bit is "1" the noise generator will produce random white noise. If bit 3 is "0" the feedback will be disabled and a periodic tone will be produced.

The two least significant bits of the noise control byte set the rate at which the shift register is clocked. Four options are available (N is the overall clock frequency);

NF1	NF0	Shift rate
0	0	N/512
0	1	N/1024
1	0	N/2048
1	1	Shift rate set by tone source 3

The fourth option allows the shift rate of the register to be controlled by the output of tone source 3. High shift rates produce high-pitched noise and low shift rates produce low-pitched noise. By varying the output of tone generator 3 the dominant pitch of the noise source can be accurately controlled.

The use of frequency sweeps to control the noise generator is demonstrated by the section of the program in listing 2 which produces a phaser sound using white noise, with both volume and frequency reducing over time.

Attenuation parameters are also specified by a single byte. Bit 7 is "1", and the next three bits are an address field which control which attenuation control register (tone source 1, 2, 3 or noise) will be updated. The four least significant bits are the actual value of the attenuation.

Compumuse: listing 1

```
10 CLS
20 PRINT "DO YOU WANT TO"
22 PRINT TAB(15);"DEFINE FREQUENCY (1)"
24 PRINT TAB(15);"DEFINE NOISE     (2)"
26 PRINT TAB(15);"QUIT THE PROGRAM (3)"
30 PRINT TAB(15);
40 INPUT "YOUR SELECTION  ";A
50 IF A<1 OR A>3 THEN 10
60 PRINT
70 ON A GOTO 100,500,800
90 REM THIS SECTION TAKES A FREQUENCY IN HERTZ AND
92 REM RETURNS THE REGISTER VALUE REQUIRED BY THE
94 REM             SN76489A
96 REM
100 CL=2000000:REM CHANGE THIS FOR DIFFERENT CLOCK FREQUENCIES
106 CLS
110 INPUT "WHAT FREQUENCY DO YOU WANT";F0
130 R0=INT(CL/(32*F0))
140 IF R0<1 OR R0>1023 THEN GOTO 1000
150 F1=CL/(32*R0)
160 F2=CL/(32*(R0+1))
170 IF ABS(F0-F1)<ABS(F0-F2) THEN GOTO 190
180 PRINT "CLOSEST ACTUAL FREQUENCY IS";F2 ;"HZ"
182 R0=R0+1:PRINT"WITH REGISTER VALUE=";R0
184 GOTO 200
190 PRINT "CLOSEST ACTUAL FREQUENCY IS";F1;"HZ"
192 PRINT "WITH REGISTER VALUE=";R0
200 PRINT
210 REM THIS SECTION TAKES A REGISTER VALUE AND
220 REM A VOICE NUMBER AND RETURNS THE TWO BYTES
230 REM WHICH MUST BE SENT TO THE OUTPUT PORT TO
240 REM LOAD THAT VALUE INTO THE APPROPRIATE REGISTER
260 INPUT "VOICE TO BE USED (1 TO 3)";V
270 PRINT
280 B=INT(R0/16)
290 A=R0-B*16+128
294 A=A+32*(V-1)
300 PRINT"FOR VOICE";V
310 PRINT"FIRST  BYTE=";A
320 PRINT"SECOND BYTE=";B
350 PRINT
360 PRINT"WHAT VOLUME DO YOU WANT (15 IS LOUDEST, 0 IS OFF)";
370 INPUT VL
380 VL=15-VL
390 VB=144+VL+32*(V-1)
400 PRINT
410 PRINT"VOLUME CONTROL BYTE=";VB
420 PRINT:PRINT "ENTER 'H' TO HEAR SOUND"
430 INPUT "OR 'R' TO RETURN TO MENU";A$
440 IF A$="R" THEN GOTO 10
450 N=253
460 OUT N,A:OUT N,B
470 OUT N,VB
480 FOR D=1 TO 100:NEXT D:GOSUB 900
490 INPUT "AGAIN (Y/N)";A$
492 IF A$="Y" THEN GOTO 460 ELSE GOTO 10
500 REM THIS SECTION FORMS THE NOISE CONTROL BYTE
504 CLS
510 PRINT"SELECT WHITE NOISE (1) OR PERIODIC NOISE (0)";
520 INPUT FB
530 NB=224+FB*4
534 PRINT
540 PRINT TAB(20);"SELECT HIGH PITCH (0)"
550 PRINT TAB(20);"      MEDIUM PITCH (1)"
560 PRINT TAB(20);"         LOW PITCH (2)"
570 PRINT"PITCH UNDER CONTROL OF TONE SOURCE 3  (3)"
580 PRINT:PRINT TAB(22);:INPUT"PITCH SELECTION";NF
584 IF NF<0 OR NF>3 THEN 534
590 NB=NB+NF
600 PRINT
610 PRINT"WHAT VOLUME DO YOU WANT (15 IS LOUDEST, 0 IS OFF)";
620 INPUT V
630 PRINT
640 V=15-V
650 NV=240+V
```

Listing continued ►

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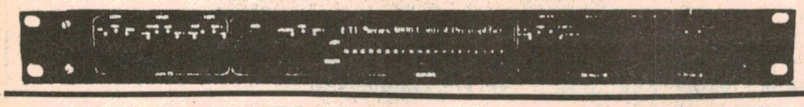
RIC SERIES 5000

As designed by ETI

PREAMPLIFIER

$259



SPECIFICATIONS

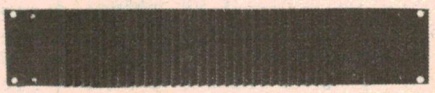
Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

POWER AMPLIFIER

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

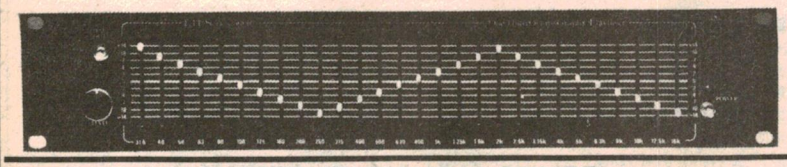
SPECIFICATIONS

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8-Hz to 65 kHz, +0−3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional



$299

THIRD OCTAVE GRAPHIC EQUALIZER

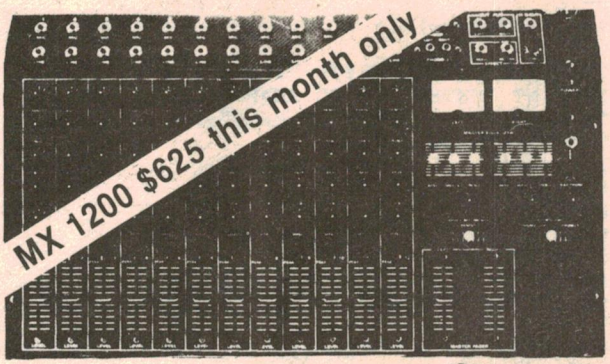


SPECIFICATIONS

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise:	<0.008 mV, sliders at 0, gain at 0 (−102 dB), 20 kHz bandwidth
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat.
Boost & Cut:	14 dB

1 unit $189
2 units $359

MX-1200 MICROPHONE/AUDIO MIXER



This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel ● LED peak indicators for each channel ● 2 turntable inputs with cross-fade and individual output controls ● master equaliser for bass, midrange and treble ● variable headphone output etc. etc. ● complete with carrying case.

$699

SPECIFICATIONS:
INPUTS
Level/Impedance Mic. 46 db/1K
Line .22 db/16K x 12
Phono .52 db/50K STEREO x 2 (.2mv) at 1KHz
Effect Return (Aux) .20 db/50K x 1
OUTPUTS
Level/Impedance L & R 0 db/2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100 -1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader; Slide; 60m/m; LOG 25%
2 Master fader; Slide; 60m/m; LOG 15%
12 F/B Volume; 300; LIN
1 F/B Master level; 300; LIN
12 Effect Send; 300; LIN
1 Effect Return; 300; LOG 15%
2 Phono; 300; LOG 15%
1 Head Phone; 300; LOG 15%
S/N. 58DB
FREQUENCY RESPONSE: 20-20 KHz
TOTAL HARMONIC DISTORTION: Less than 0.1%
METER: 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR: 12 LED Peak Indicators
VOLTAGE: 240 VAL 50Hz
POWER CONSUMPTION: 7.2 watts
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

EXTRA FEATURES OF OUR KITS
POWER AMPLIFIER
KIT PRICE $299 P&P $8.00

- 1% Metal Film Resistors are used where possible
- Prewound Coils are supplied
- Aluminium case as per the original article
- All components are top quality
- Over 200 Kits now sold
- We have built this unit and so know what needs to go into every kit
- SUPER FINISH Front panel supplied with every kit at no extra cost to you
- We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this applifier puts out. This is done on a per order basis delivery approx. two weeks after placement.

only $425

**All parts available separately for both kits.*

PREAMPLIFER
KIT PRICE $259 P&P $8.00

- 1% Metal Film Resistors are supplied
- 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes)
- English "Lorlin" Switches are supplied no substitutes as others supply
- We have built and tested this unit and so know what needs to go into every kit
- Specially imported black anodised aluminium knobs
- Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the P.A.

only $425

Errors and omissions excepted.

Bankcard mail orders welcome
ORDER FORM
Please Debit my Bankcard
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Expiry Date.....
Name.....
Signature.....

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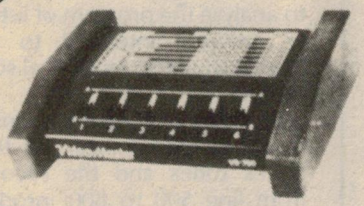
ROD IRVING ELECTRONICS

2 BRANCHES: 425 High St. Northcote, Ph.: (03) 489 8131
48-50 A'Beckett St. Melb. Ph.: (03) 347 9251
Mail orders: P.O. Box 235 Northcote, Vic. 3070

No. 1 for Video accessories

Built and tested

Video Switching box



$47.50

Low loss R.F. switching—allows inputs for:- VCR, video disc, antenna, cable TV, home computer and video games.

WE HAVE A GREAT RANGE OF VIDEO CONNECTORS AND CABLES FOR VIDEO TO VIDEO DUBBING.

Cables

PA-25
5 pin 180 degree dubbing adaptor—Reverse pins for video use **$6.95**

VC-14
8 pin square plug to 8 pin square plug. Cable length 2 metres **$29.95**

VC-15
6 pin DIN plug to 6 pin DIN plug. Cable length 1.5m **$4.95**

VC-1
BNC plug to BNC plug. Impedance-75Ohm. Cable length 1.5m **$6.50**

VC-2
BNC plug to PL259 plug. Impedance-75Ohm. Cable length 1.5m **$6.75**

VC-3
PL 259 plug to PL 259 plug. Impedance-75Ohm. Cable length 1.5 **$4.95**

VC-4
PL 259 plug to RCA plug. Impedance-75Ohm. Cable length 1.5m **$4.95**

VC-5
RCA plug to RCA plug. Impedance-75Ohm. Cable length 1.5m **$5.95**

VC-6
BNC plug to RCA plug. Impedance-75Ohm. Cable length 1.5m **$5.95**

Video Connectors

VP-8
8 pin square video connector plug **$7.50**

VS-8
8 pin square video connector inline socket **$7.50**

VP-10
10 pin male video plug. Used in J.V.C., Panasonic, Sharp and other VHS machines **$11.50**

VS-10
10 pin female inline socket. Used in J.V.C., Panasonic, Sharp and other VHS machines **$11.50**

VP-14
14 pin male video plug. Used in Sony, Sanyo, Toshiba and other Beta machines **$16.50**

VS-14
14 pin female inline socket. Used in Sony, Sanyo, Toshiba and other Beta machines. **$16.50**

VIDEO HEAD CLEANERS

HC-1 V.H.S. Video head cleaner
HC-2 Beta Video head cleaner

A professional head cleaner—employs new "double sided" cleaning action—no need to "operate" on your machine. Just insert the cassette, play for 30 seconds and the job's done. Effective for 100 operations.

HC-1 $17.50 HC-2 $17.50

Built and tested

Video Enhancer

Detail Enhancer VP5030 is another important contribution to the world of video accessories. The lightweight Detail Enhancer has been particularly designed to rectify loss in detail derived from VCR tapes and picture impairments. With simple adjustments for more or moderate detailing, the detail enhancer can also overcome such picture impairments as loss of detail and disappearance of verticle lines.

Bargain Price $87.50

Specifications:
1. Power requirement: 12V DC 110mA
2. Input: 1 Video (RCA connector)
3. Outputs: 3 Videos (RCA connectors)
4. Output lever: Video outputs: 1.0Vp-p, 75 Ohm unbalanced below 1Vp-p out.
5. Enhance: Enhance 9dB (Referenced/1.0Vp-p)
6. Signal-to-noise ratio: Greater than 50dB below 1Vp-p out.

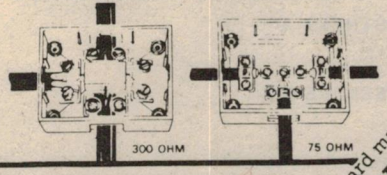
TDK E180 VHS VIDEOTAPES 10 for $148.00

Unbelievable Value!!

T.V. and F.M. Splitters

Model	F Range (MHz)	Impedence (Ohms) IN	Impedence (Ohms) OUT	Output	Band	Splitting loss	Isolation	VSWR
DDF-332 U/V	50-890	300	300	2	VHF	3.5	25	1.5
					UHF	4	20	1.7
DDF-772 U/V	50-890	75	75	2	VHF	3.5	25	1.5
					UHF	4	20	1.7
DDF-774 U/V	50-890	75	75	4	VHF	6.7	30	1.4
					UHV	7.6	22	1.8

DDF-332 $3.95, DDF-772 $4.95, DDF-774 $6.95



Errors and omissions excepted.

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2 BRANCHES:

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48-50 A'Beckett St. Melb. Ph.: (03) 347 9251

min p&p $3.00

Mail orders: P.O. Box 235 Northcote, Vic. 3070

bankcard

Bankcard mail orders welcome
ORDER FORM
Please Debit my Bankcard
No.....
Expiry Date.....
Name.....
Signature.....

```
660 PRINT"NOISE CONTROL BYTE   (SENT FIRST)=";NB
670 PRINT"VOLUME CONTROL BYTE (SENT SECOND)=";NV
680 PRINT:PRINT"ENTER 'H' TO HEAR SOUND"
690 INPUT "OR 'R' TO RETURN TO MENU";A$
700 IF A$="R" THEN GOTO 10
710 N=253
720 OUT N,NB:OUT N,NV
730 FOR D=1 TO 100:NEXT D:GOSUB 900
740 INPUT "AGAIN (Y/N)";A$
750 IF A$="Y" THEN GOTO 720 ELSE GOTO 10
800 END
900 REM THIS SECTION SHUTS UP ALL SOUND
904 N=253
910 N=253
920 OUT N,159:OUT N,191
930 OUT N,223:OUT N,255
940 RETURN
1000 PRINT "SORRY, FREQUENCY IS OUT OF RANGE"
1010 INPUT "PRESS 'ENTER' TO RETURN TO MENU";A
1020 GOTO 10
```

Compumuse: listing 2

```
10 CLS
20 GOSUB 1000:REM TURN OFF ALL SOUND
30 N=253
40 PRINT "BELL (1), PHASER (2), BIRDS (3), OR EXPLOSION (4)"
50 INPUT "SELECT 1, 2, 3 OR 4";A
60 ON A GOSUB 90,220,320,440
70 GOTO 10
80 :
90 PRINT "BELL SOUND"
100 OUT N,140:REM SET VOICE 1 TO 679HZ
110 OUT N,5
120 OUT N,170:REM SET VOICE 2 TO 694HZ
130 OUT N,5
140 FOR B=0 TO 3:REM NUMBER OF CHIMES
150 FOR I=145 TO 159:REM LOOP THROUGH ATTENTUATION STEPS
160 OUT N,I:OUT N,I+32
170 FOR D=0 TO 40:NEXT D:REM LENGTH OF A CHIME
180 NEXT I
190 NEXT B
200 RETURN
210 :
220 PRINT "PHASER SOUND"
230 OUT N,231:OUT N,240
240 FOR L=0 TO 15
250 FOR A=192 TO 207
260 OUT N,A:OUT N,L
270 NEXT A
280 OUT N,(240+L)
290 NEXT L
300 RETURN
310 :
320 PRINT "BIRDSONG":T=0
330 S=INT(RND(10)):REM RANDOM CHIRP LENGTH
340 OUT N,144
350 FOR I=0 TO 10
360 OUT N,(128+I)
370 OUT N,1
380 FOR D=0 TO S:NEXT D
390 NEXT I
400 T=T+S
410 IF T=>200 THEN RETURN
420 GOTO 330
430 :
440 PRINT "EXPLOSION SOUND"
450 OUT N,230:REM SET HIGH PITCHED WHITE NOISE
460 FOR I=240 TO 255:REM LOOP THROUGH ATTENUATION VALUES
470 OUT N,I
480 FOR D=0 TO 75:NEXT D:REM LENGTH OF SOUND LEVEL
490 NEXT I
500 RETURN
```

Listing continued ►

With all four bits set, attenuation will be maximum (no sound). With these four bits "0" there will be no attenuation (maximum volume).

Programming sound effects

Perhaps the best way to understand how to program the sound generator is to analyse the program of listing 1, a utility program intended to aid in the development of music and sound effects routines.

There are two main sections of the program. The first, lines 100 to 500, produces tones and the second section, from line 500 to 800, produces noise. Lines 10 to 70 ask for the user's choice and jump to the appropriate routine.

As previously explained, the SN76489AN produces tones by dividing a clock frequency. The correct value for this frequency must be inserted in line 100. Our prototype uses a 2MHz clock frequency.

Line 110 asks for the frequency of the tone required. Given the frequency, F0, the divider value is calculated in line 130, using equation 2.

The maximum number that can be stored as a 10-bit binary value is 1023. If the required register value is greater than this figure, the frequency requested is below the lower limit of the sound generator's range. If it is less than 1 the required frequency is too high. In either of these cases the program returns to the start-up menu via lines 1000-1020 which inform the user of the problem.

Since the register value increases in discrete steps from 1 to 1023, not all frequencies can be produced accurately. Lines 150 and 160 calculate the frequency that will be produced with the calculated integer register value, and with a value one larger than the calculated value. Sometimes this frequency will be closer to that required than the frequency produced by the original register value.

Line 170 tests which of the two frequencies is closest to the value required and directs the interpreter to print either the first or the second frequency and its associated register value.

We are not yet finished. Given a 10-bit register value we must convert it into binary for storage as two bytes in the sound generator's internal registers.

Dividing by 16 shifts the binary value of R0 four places to the right, giving the correct value for the six least significant digits of the second control byte. These are the six most significant bits of the register value.

The first control byte, containing the four least significant bits of the register value, can be calculated by subtracting the value of the second byte multiplied

EASTERN
COMMUNICATIONS ELECTRONICS & COMPUTERS

FOR ALL YOUR ELECTRONIC NEEDS DROP IN AT EASTERN

See EA November, 1982

POWER UP
A MUST FOR YOUR COMPUTER SYSTEM

This great new Project from EA is the answer to a Maiden's Prayer.

What Does it Do?

A single 240v mains plug and lead feeds one unswitched master 240v outlet plus 4 switched 240v outlets. **With say a hi-fi system,** plug your main equipment item (eg Amp) into the master outlet and whenever you "switch on" your amp — presto — mains power is applied to the other 4 outlets ie simply "turning on" your amp turns on your tape cassette, tuner, turntable, graphic equaliser without mains spikes, plops, etc.

Just the shot for your Computer System.

The Altronics Kit includes case and all outlets.

Cat K6000.....$39.50

LABORATORY MULTIMETER
100K OHMS/VOLT CHECKS TRANSISTORS AND MEASURES CAPACITANCE

Q 1040 Multimeter **$72.50**
Q 1041 Carry Case **$14.50**

From Tokyo Laboratories, Japan

Remember the days when high grade precision laboratory multimeters were available only from UK and then they cost a King's Ransom?! — Well, that's history — the new Q 1040 is everything a high quality meter should be **PLUS** it checks transistor HFE and ICO and measures capacitors from 50pf-50UF.

★ 100K OHMS/Volt DC ranges ★ 8.5 UA movement ★ Fuse and diode movement protected ★ Inbuilt oscillator for capacitance measurement. **RANGES: DCV** 250MV, 2.5V, 10V, 50V, 250V, 1000V. **ACV** 5V, 10V, 50V, 250V, 1000V (10K/V). **DCA** 10UA, 2.5MA, 25MA, 500MA, 10A. **ACA** 10A **Resistance** x1, x10, x1K, x10K. **Transistors** NPN/PNP **HFE** 0-1000 **ICO** 0-50UA. **Capacitors** 50PF-3UF. .01 UF-50UF.

DIGITAL FREQUENCY METER

See Electronics Aust Mag Dec 81-Feb'82

500MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE

IMPORTANT NOTES:

(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.

(2) ALTRONICS USE ONLY THE SPECIFIED INTERSCIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.

★ Screened front panel ★ Bright high efficiency 7 segment display ★ Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler) ★ 4 gating times — 01, .1, 1, 10 seconds ★ 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution ★ High input sensitivity — 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance ★ High accuracy — typically better than .005%/count uncalibrated.

Costs a fraction of commercial counters.

EXCLUSIVE ALTRONICS KIT FEATURES:

★ IC sockets provide throughout.
★ Low aging 10,000MHz ×TAL.
★ Thermalloy heatsink for 5V regulator.
★ Quality Pactec Instrument Case.

K 2500 (50MHz version) **$119.50**
K 2501 Pre-scaler **$26.00**
(add for 500MHz version)

Incredible!

UNIVERSAL MULTIMETER
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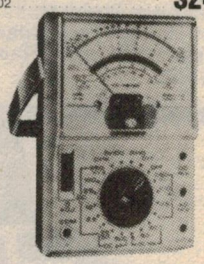
23 ranges at less than $1 per range.

★ 20,000 OHMS/Volt DC ★ 10,000 OHMS/Volt AC ★ Mirror backed scale ★ Overload protected ★ Unique carry handle doubles as a bench stand ★ High-impact resistant case ★ Uses 1 AA Penlight battery (incl) ★ Comes complete with battery, test leads and instructions. **RANGES: DC Voltage** 0-25, 1, 2.5, 10, 25, 100, 250, 1000. **AC Voltages** 0-10, 25, 100, 250, 1000. **Decibles** 20 to +22db. **DC Current** 0-50, 500 UA, 0-5, 50, 500MA. **OHM Meter** 0-6 megohms in 4 ranges, 30 ohms centre scale. Size 135 x 91 x 39.

Q 1002 ..... **$24.50**

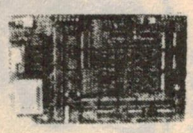


COMPLETE RANGE OF ICOM AND KENWOOD ON DISPLAY AT ALL TIMES.

ICOM IC720A $1,199

KENWOOD TS930S $1,999

ETI'S BRILLIANT NEW DIRECT-CONNECT COMPUTER MODEM



Employs unique "Commutated Filter" design overcoming virtually all the problems involved with conventional modems. Super flexible unit facilitates communications between computers over cables, the telephone network and radio links. Unit connects to a standard RS 232 interface and is capable of both 1200/75 Baud and 300/300 Baud transmission and reception ★ Line switching; answer and dialing facilities on board.

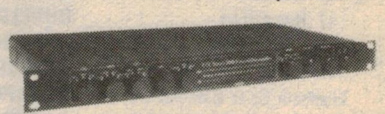
EXCLUSIVES: ★ Plated through, double sided PCB ★ Complete set of IC sockets ★ Kit requires 85 IN914 Diodes for programming these are included ★ Ceralock resonator and matching balanced load capacitor used for long life and high accuracy ★ Telecom approved isolating transformer and Reed relays included.

K 9644(See ETI Oct 82) **$169.50**

THE SUPERB 5000 SERIES

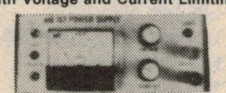
5000 PWR AMP 100W $319.00

5000 PREAMPLIFIER $299.00



NEW ETI 162 POWER SUPPLY
0-30V at 1 amp

With Voltage and Current Limiting



★ Overload and Short Circuit Protected.
★ Full Voltage and Current Metering.
★ Fully variable voltage and adjustable current limiting.

Exclusive — Fully SEC Certified Mains Transformer supplied.

If you're considering buying this kit from your local supplier or one of our competitors — first ring and ask them if the mains transformer is SEC certified to ASC126 — chances are that it won't be.

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K 3205 ..... **$49.50**

10 Hz 20 MHz BAND WIDTH

The Brilliant New MICRON 12 Green Phosphor Monitor

Features 12 inch Screen, **Front Controls** On/Off, Contrast/Reverse, Brightness, **Power** 240V/50Hz or 12V DC, **Input** RCA Type, **DC Output Jack** 12V/1.1 AMP — power your micro direct without a power pack. **Bandwidth** 10Hz to 20MHz **the resultant definition is truly amazing for a low cost monitor.**

GUARANTEED BY ALTRONICS! Incredible Value

Cat D1112 ..... **$199.50**

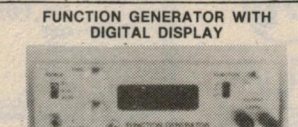
POWERFUL NEW 6000 RPM MINI DRILL FOR PC WORK

Tons of Torque. Just the shot for PCB work. 12V DC operated from external Power Pack 1.2mm chuck capacity. Supplied c/w 1mm drill bit.

T 2302 ..... **$12.95**

Drill Bits:
T 2320 (0.8mm) **$1.25**
T 2325 (1.0mm) **$1.25**

FUNCTION GENERATOR WITH DIGITAL DISPLAY



EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%.

K 2505 ..... See EA April, 1982 ..... **$85.00**

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This brilliant little 30 watt iron is just the "bee's knees" for the electronics hobbyist, electrician or home handyman. We searched the world for a low cost yet quality iron which met the criteria of ★ light-weight ★ screw in interchangeable tips ★ efficient thermal transfer from element to tip ★ tip temperature maintains within the limits suitable for electronic work and also small household jobs ★ and of course, fully SEC tested amd approved.

Comes fitted with T 2435 Tip

T 2430

REPLACEMENT TIPS $12.50

T 2434 Flat Tip ..... .95
T 2345 Conical Tip ..... .95
T 2436 Instrument Tip ..... .95

DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1 PF — 99.99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

★★★ **EXCLUSIVE TO ALTRONICS** ★★★

Each kit now includes precision measured capacitors for accurate calibration of each range.

K 2521 ..... **$55.00**

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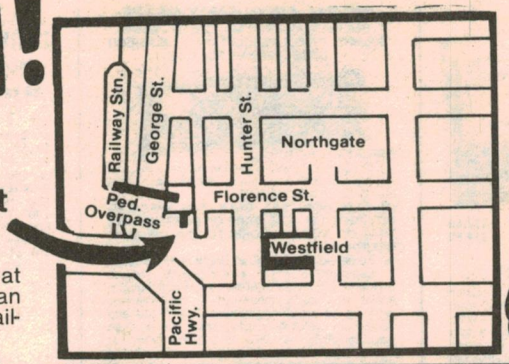
In the Florence Street Mall at the foot of the Pedestrian Overpass from Hornsby Railway Station.



Where you'll receive friendly, professional service and advice from our specially trained sales staff. You'll also get the famous Dick Smith low Direct Import prices and our exclusive 7 day money back Satisfaction Guarantee on everything we sell. Don't miss out!

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	Main South & Flagstaff Rds	DARLINGTON	298 8977
	Main North Rd & Darlington St	ENFIELD	260 6088
WA	Wharf St & Albany Hwy	CANNINGTON	451 8666
	William St & Robinson Ave	PERTH	328 6944
	Centreway Arc, Hay St	PERTH	321 4357
TAS	25 Barrack St	HOBART	31 0800

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Dick Smith and Staff

THE AUSTRALIAN COMPANY

PARTS LIST

1 loudspeaker
1 9V DC plugpack
1 printed circuit board, 106mm x 48mm, code 83ms4
1 4MHz crystal
1 30cm length of 11-way ribbon cable
1 36-way edge connector or other connector to suit.
1 heatsink (see text)

SEMICONDUCTORS
1 74LS00 quad NAND gate
1 7474 dual D-type flipflop
1 SN76489AN sound generator
1 LM386 audio amplifier
1 7805 +5V voltage regulator

RESISTORS (¼W, 5% unless stated)
1 x 10kΩ, 1 x 2.7kΩ, 2 x 470Ω, 1 x 22Ω, 1 × 10Ω, 1 × 10kΩ vertical mounting trimpot.

CAPACITORS
1 470µF/16VW electrolytic
1 220µF/16W electrolytic
1 10µF tantalum
2 1µF tantalum
1 0.1µF polystrene
1 .003µF greencap
1 .01µF ceramic

MISCELLANEOUS
Tinned and insulated copper wire
Solder
Case and PCB stand-offs to suit

We estimate that the current cost of parts for this project is approximately

$20.00

This includes sales tax but does not include a plugpack, case or cabling.

Listing 2 continued:

```
1000 REM TURN OFF ALL SOUND
1010 N=253
1020 OUT N,159
1030 OUT N,191
1040 OUT N,223
1050 OUT N,255
1060 RETURN
```

by 16 from the original register value. Bit 7 of the first byte must be 1, and so we set this bit by adding 128 to the value of the first byte.

The first control byte also contains a 3-bit register address which determines which register the control bytes will be sent to. So far we have calculated the first control byte with these bits (b6, b5 and b4) zero, so the first byte addresses the frequency control register for tone 1.

The control register for tone source 2 is addressed by setting b5 to 1 (equivalent to adding 32 to the value for tone 1). The frequency control register for tone source 3 can be accessed by setting b6 (adding 64 to the value calculated for tone 1).

Line 294 takes care of this adjustment. Given a voice number, V we need to add 0 for voice 1, 32 for voice 2 and 64 for voice 3. This can be achieved by adding 32*(V-1) to the value for the tone 1 frequency control register to give us the control value for the same frequency produced by tone source 2 or 3.

Attenuation registers

We now have two bytes which when sent in the correct order to the sound generator will program the desired frequency from the tone source specified. Sending these bytes will not produce sound, however until the attenuation register for the appropriate tone source is programmed.

Line 360 asks for the volume level required. Volume is specified as a number between 0 and 15, with 15 being the loudest. This is the opposite of the Texas Instruments convention, which specifies attenuation, with maximum attenuation (no sound) represented by 15 and minimum attenuation (full volume) represented by 0.

Line 380 makes this adjustment, subtracting the volume number we type from 15 to give us the attenuation code.

Attenuation control bytes have the most significant bit (b7) set to 1. The next three bytes are the register addresses. Since we are only specifying attenuation control registers here, b4 will always be "1". This gives us a base value of 144, which would address the attenuation control register of tone source 1.

By adding 32 multiplied by the voice number minus 1 we can arrive at the correct address for the attenuation register of any tone source. When the lower 4 bits calculated by line 380 is added to this base value we have the specified attenuation control byte for the required voice. This addition is done in line 390 and the result printed by line 410.

Our frequency control bytes are now complete, with two bytes specifying the tone to be produced by the chosen source and a third byte specifying volume. The next section of the program gives us the choice of hearing the tone created or returning to the initial menu to specify further notes. (Lines 420 to 492.)

Tones are played by outputting the first tone control byte then the second and then the volume control byte. On the System-80 the address of the parallel printer port of the expansion interface is FD, or decimal 253. Lines 450-470 output the control values. Line 480 determines the duration of the sound produced. To use this routine on the TRS-80 Model 1, change line 450 to N = 14312 and change all OUT N, xxx statements to POKE N, xxx

After sounding the tone, the program gives the user the choice between hearing it again or returning to the main menu. Take particular note of the subroutine beginning at line 900. This routine disables all sound sources by setting the attenuation control bytes for maximum attenuation (silence). It's best to type this part of the program first, as when the computer is switched on with the sound generator attached . . .

The second section of the program calculates noise control bytes. The noise control byte is made up a 1 in the most significant bit position, a 3-bit register address field, a feedback bit for selecting random or periodic noise and two pitch control bits. Bit 3 of the byte can be either 1 or 0.

The "base value" of the noise control byte is 224, calculated as follows:

Bit 7 set to 1 gives 128. The address of the noise control register is 110, in bit positions b6 to b4, giving 96. Adding these two values gives us 224.

The first choice is between random and periodic noise. One bit of the noise control register determines whether the feedback network of the shift register is enabled (for white noise) or disabled (for periodic noise).

The feedback bit is in bit position b3, which has a decimal value of 4 when set to 1. If we specify the feedback bit as a 1 for random noise and multiply it by 4 before adding it to the base value, the feedback bit will be correctly set.

Bits 1 and 0 control the pitch of the noise source. With both 0, we get high pitch, while bit 0 set will give medium pitch and bit 1 set will give low pitch. Both bits set will place the noise pitch under the control of tone source 3.

Conveniently, the fact that the pitch control bits are in the two least significant bit positions means that if we specify high pitch as 0, medium as 1 etc, we can simply add the value of the pitch selection number to the calculated base value. Adding 1, for instance, will reset b1 and set b0, for medium pitch. Adding 3 will set both b1 and b0, placing the noise pitch under the control of tone source 3.

continued on p.141

How to obtain better TV reception: Pt. 3

By far the most important factor in obtaining good TV reception is the antenna. And having some understanding of antenna principles will help you to select an antenna for best reception in your location.

by LEO SIMPSON

A great many people living in Sydney do not have good reception of channel 0 and many of these people blame the station when they really should be blaming their own antenna. Some of these people even go to the trouble of installing a new antenna which does little to solve their problem. With knowledge of the principles involved, anyone who presently has good reception can get equally good reception of channel 0.

To gain some idea of how an antenna works it is necessary to understand the nature of a radio or television signal. The usual description goes something along the lines that "a radio signal is a form of electromagnetic radiation which travels at the same speed as light (in air or vacuum) at 300,000 kilometres per second". The term "electromagnetic" is the essential clue since it implies that a radio wave has two components: electric and magnetic.

How do these two components come about? In fact, wherever there is a varying electric field there is always an associated magnetic field although it is customary to ignore the existence of magnetic fields in much of electronics.

How a radio signal is radiated

Consider a length of wire to which is applied an AC voltage. Because of the voltage a given alternating current will flow through the wire and this will set up an associated magnetic field around the wire which will vary in exact unison with the current. The magnetic field will be perpendicular to the wire and thus perpedicular to the voltage field applied to the wire.

Fig. 1 shows the relationship between the voltage field and the magnetic field. The voltage field is, in fact, the electric field referred to earlier. Many people have trouble visualising an electric field although they have no trouble visualising a magnetic field. The evidence of a magnetic field can be made visible by sprinkling iron filings on a piece of paper which lies over a bar magnet. This shows the lines of force of the magnetic field which run from the north pole to the south pole of the magnet.

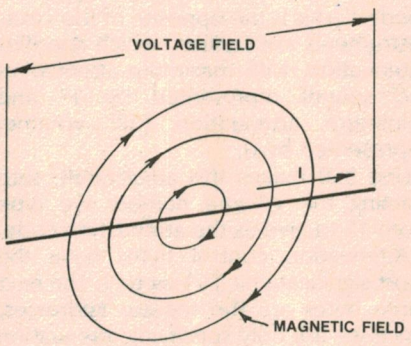


Fig. 1

Similarly, an electric field (also known as an electrostatic field) has lines of force which run from a positively charged point to a negatively charged point. Fig. 1 shows the direction of the lines of force of both the magnetic and the electric fields.

So the length of wire in Fig. 1 has an electric field and a magnetic field associated with it and this will be radiated out from the wire with both fields becoming weaker as the distance from the wire increases. In fact, the wire can be regarded as a rudimentary antenna radiating energy out into space in the form of magnetic and electric fields.

Think about that for a moment. Can energy be radiated in the form of magnetic and electric fields? Yes. We can also store energy in magnetic and electric fields. Consider the energy stored in the magnetic field of an automotive ignition coil or the energy stored in the electric field between the plates of a high voltage capacitor (such as used in the capacitor-discharge ignition system).

The units of electric field intensity are volts/metre and the units of magnetic field intensity are ampere-turns/metre. As we shall see, RF signal strength, as radiated from an antenna, usually refers to the electric field and is measured in volts/metre or in practice, in millivolts/metre.

Before leaving Fig. 1, we can say that it radiates an electromagnetic wave which moves at 300,000km/sec into space and which varies at the frequency of the alternating voltage applied to the wire. If we move some distance away from the wire, we can visualise this wave as two planar fields at right angles to the direction of motion. Fig. 2 shows three axes for such a wave.

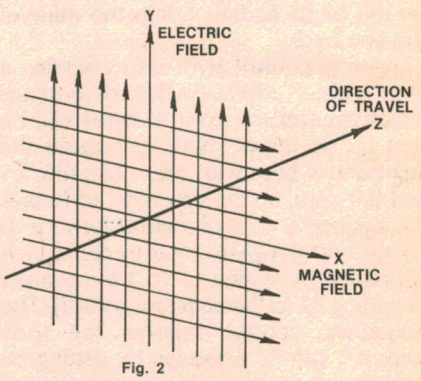


Fig. 2

The z-axis represents the direction of motion; the y-axis the direction of the electric field and the x-axis the direction of the magnetic field. In antenna parlance, the electric field is said to be the E-field and the magnetic field is said to be the H-field.

At this point, we are ready to have a look at how a basic antenna receives or picks up such an electromagnetic wave. Let's place a length of wire in the path of the wavefront of Fig. 2. Further, let's

position the wire so that it is parallel to the lines of the electric field. This means that as the wavefront passes the wire, the lines of magnetic force will cut it. This will cause a current to flow in the wire and a voltage to be developed across it.

The voltage developed across the ends of the wire will be the product of the length of the wire and the field strength of the wavefront. For example, if the length of wire was one metre and the field strength was one volt/metre, the voltage induced between the ends of the wire would be one volt.

If the reader was to stop at this point

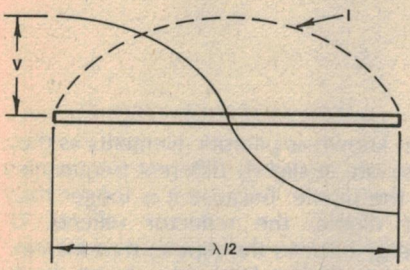


Fig. 3

he could easily conclude that the foregoing is all you need to know. He might well say "the antenna wire picks up signal in proportion to its length. Therefore, the longer I make the antenna, the better". Well that happens to be true for antennas which are used for relatively low frequencies, such as for the AM broadcast band but for higher frequencies we need to consider the concept of wavelength.

Wavelength

Just as sound waves have a wavelength which is found by dividing the velocity by the frequency then so do electromagnetic waves. In this case, the velocity (in vacuum) is the same as for light, being 300,000km/s or 3×10^8 metres per second. So if the frequency of the electromagnetic wave we are concerned with is 150MHz, then the wavelength will be two metres.

Wavelength is the distance between two successive corresponding points, peaks or troughs, on a wave. If we then take a one-metre length of wire and place it so that it is cut by an electromagnetic wave (ie, so that it is parallel to the lines of the electric field) with a frequency of 150MHz. we would find that a current would flow between the ends of the wire and a voltage would be induced between the ends.

But by having a length of one metre we note a special relationship between the voltage, current and the wavelength. If we were to measure the voltage and current at various points along the wire we would find the values depicted in Fig. 3. This shows the voltage maxima at the ends of the wire while the current minima are at the same points.

This photo is repeated from last month's article on ghosting because it was not reproduced properly. The faint vertical bar about one-tenth of the width of the picture is the ghost of the horizontal sync pulse. In most cases it is darker but it may also be lighter than the rest of the picture.

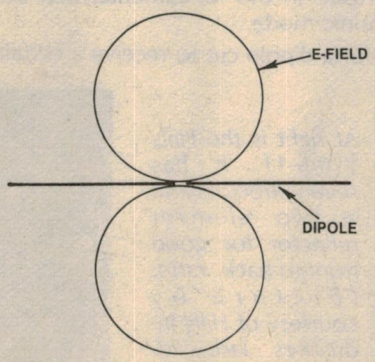


Fig. 4

What we observe along the wire is, in fact, a "standing wave" and it is analogous to a standing wave in a taut length of string. The current minima in the wire (at the ends) are equivalent to the nodes (stationary points) in the oscillating string. This is resonance.

If we now cut this half wavelength of wire in two we have a resonant dipole, the basic building block used in just about all TV antennas.

Polarisation

The dipole is often referred to as a "doublet" because of the shape of the electric field radiated by it when used as a transmitter or the response pattern when used as a receiver.

If we looked down from immediately above a dipole used as a transmitter and plotted the amplitude of the electric field radiated in all directions from it we would find a characteristic double-lobe pattern, as in Fig. 4. Hence the name "doublet". Such a horizontal antenna is said to be horizontally polarised. Note that polarisation refers to the direction of the electric field, not the magnetic field.

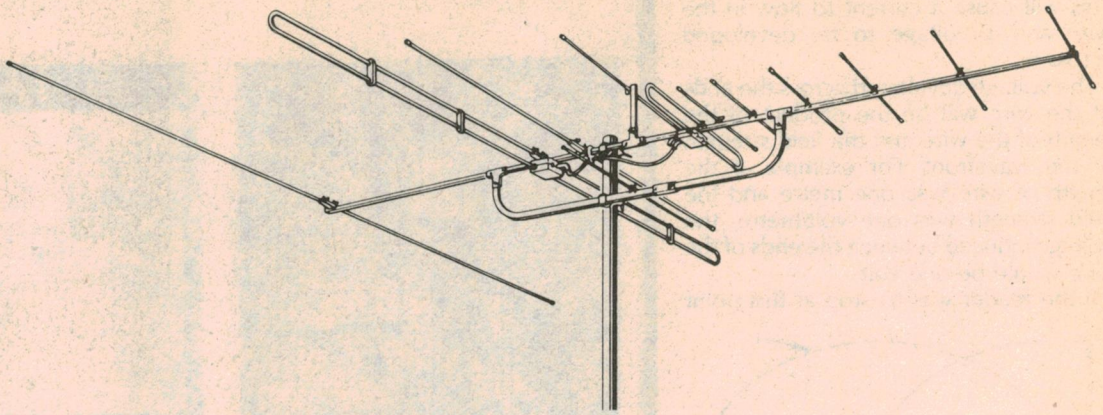
As hinted above, a dipole antenna has the same polar pattern for transmission as for reception by the law reciprocity. This means that if a horizontal dipole is used as the transmitter than the receiving antenna must also be a horizontal dipole (or variant thereof) to pick up the horizontally polarised transmitted wave. If a vertical receiver antenna was used it would be at right angles to the electric field and parallel to the magnetic field and, in theory, it would pick up no signal at all. In practice, it would pick up some signals but the resulting reception would be awful.

From Fig. 4 it can be seen that the signal pickup end-on to the dipole is at a minimum or "null" while it is maximum at any direction exactly at right angles (including above and below).

Therefore, for the dipole antenna to work correctly it must have the same polarisation as the transmitting antenna and it must be oriented (ie, pointed) so that it is broadside to the wavefront from the transmitter.

From the shape of the pattern in Fig. 4 the dipole antenna is said to be bidirectional which means that it has the same response from the front as it has from

How to obtain better TV reception



This German-made Wisi FC12 antenna covers channels 0 to 2 and channels 6 to 11. The three long elements cover the low band while the rest cover the high band. (Diagram by courtesy of Paul's Antenna Service Pty Ltd, Narrabeen, NSW.)

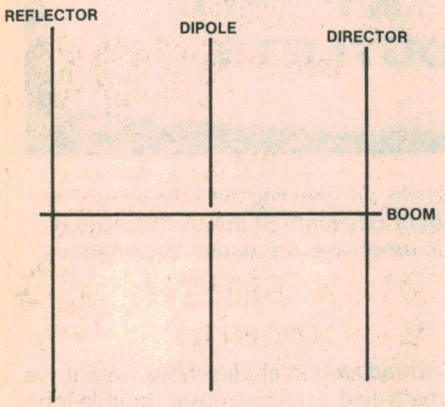


Fig. 5

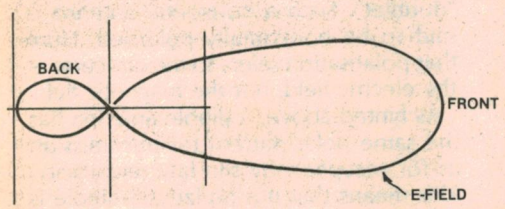


Fig. 6

the back. In fact, the terms back and front are quite meaningless.

While dipoles are used as the most basic TV antennas, for example, TV "rabbit ears" and caravan antennas, the doublet pattern is not very suitable for getting rid of ghosts unless by some fluke the ghost was exactly at right angles to the direction of pickup whereby it would fall in the null.

There is another reason why the simple dipole may not be adequate and that is that the signal picked up by it may be insufficient for satisfactory reception. For completely noise-free reception a typical TV receiver requires a signal of as much as one millivolt RMS (regardless of the frequency), although signals very much less than that may be deemed "watchable".

If the TV is to be driven with this amount of signal, the product of the dipole length and the electric field strength must equal one millivolt. For reasons which should now be obvious, we can't vary the length of the dipole; it must be at its resonant length and because of the way in which standing waves occur in an antenna, increasing its length will not yield any increase in received signal. In fact, if a dipole is to be used and still obtain its basic "doublet" response pattern it must be operated at or near its fundamental resonance or at its odd harmonics, ie, 3rd, 5th and so on. Normally, for TV reception, dipoles are only used in the fundamental and 3rd harmonic mode.

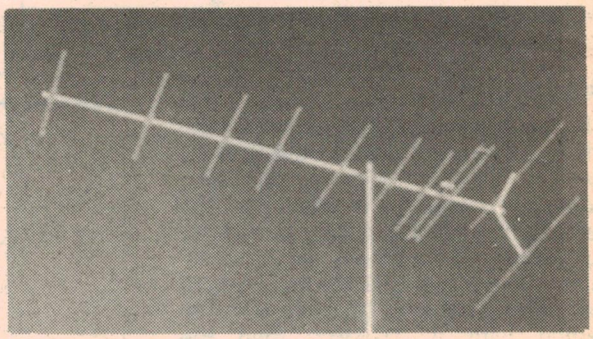
So for a dipole cut to receive a certain frequency, the signal picked up will depend solely upon the field strength. If that is not enough an antenna with more gain has to be used. Gain in a resonant dipole antenna can be obtained in two ways only. First, elements may be stacked to increase the effective capture area of the resultant antenna or other elements may be added in front and back of the dipole to change the shape of its response pattern. Antennas of the latter form are known as Yagis after the Japanese inventor, Hidetsugu Yagi, who devised the first such antenna in 1928. The simplest form of Yagi is depicted in Fig. 5. It has two other elements besides the dipole.

The shorter element in front of the dipole is known as a director while the slightly longer element behind the dipole is known as a reflector. These are also known as parasitic elements as they resonate at slightly different frequencies to the dipole. Because it is longer than the dipole, the reflector reflects RF energy back to the dipole, thus increasing the effective field strength seen by it.

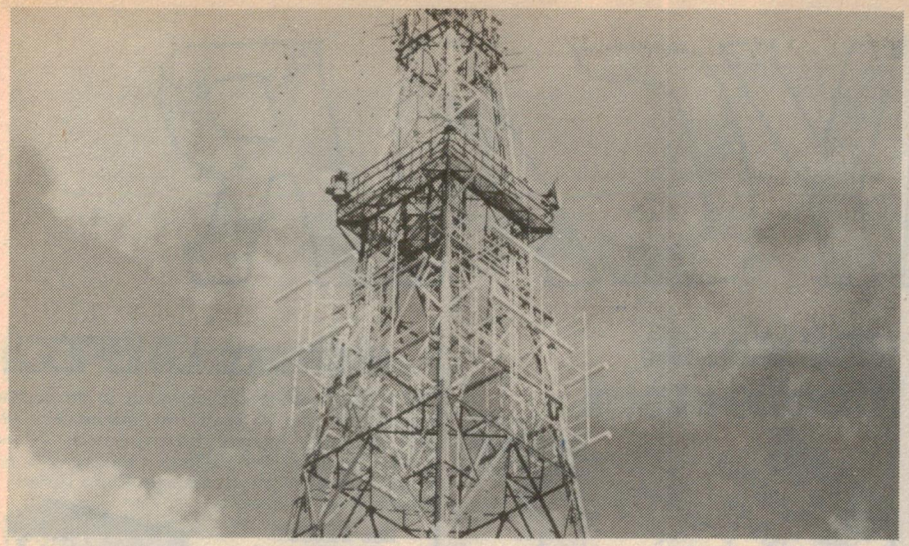
Antenna gain

In a less obvious way, the resonance of the director is close to the dipole resonant frequency and radiates some of the signal picked up by the director back to the dipole to again increase the field strength seen by it. Both of these effects have the result of changing the polar response pattern as well as increasing the gain. Reference to Fig. 6 shows how the lobe to the rear of the Yagi has been much reduced while that at the front has been elongated to indicate the greater gain in the forward direction and the reduced forward "acceptance". Now the pattern has a recognisable front and back (compared to a dipole). We can now talk about front/back ratio which is expressed in decibels and is a measure of the antenna's ability to reject unwanted (ghost) signals from the rear.

Also expressed in decibels is the gain of the antenna. Compared to a dipole, a three-element Yagi typically has a power gain of around 6dB. If the gain is referred to an isotropic antenna which is a hypothetical concept of an antenna which radiates equally in all directions, the gain figure is increased by 2.1dB. The



At right is the Hills Y10/6-11. It has seven directors and a two element reflector for good front-to-back ratio. (Picture by courtesy of Hills Industries Ltd, Edwardstown, SA.)



Most TV antennas are variations on the basic dipole antenna as described in this article. This large array is for Channel 0 in Sydney. The large dipoles can be easily recognised, ie, the hefty lengths of horizontal pipe painted white.

first gain figure should really be expressed in the form "dBd" while the second is "dBi".

The foregoing gain figure of 6dB compared to a dipole assumes that all elements have been cut for maximum gain at a particular frequency. Unfortunately though, a TV transmission encompasses a band of frequencies about 7MHz wide. In order to cover this range, several measures are adopted. First, the dipole is folded, and appears rather like a squashed loop. Second, the reflector is cut longer and the director is cut shorter, to spread the range.

These measures increase the bandwidth but they also reduce the gain so that for a typical three-element array for single-channel TV use, the gain may only be 5dB. The situation gets worse, as viewers normally want to watch more than one channel.

Widerange Antennas

With the best will in the world, antenna designers have great difficulty in arranging for a Yagi to cover more than about one-third of an octave (ie, a range of 1.3:1) and such an antenna would have a lot of directors while not having a great deal of gain.

As an example of an antenna which just about represents the limit to which a single Yagi can be developed for TV coverage, consider the Hills Y14/611. This Australian made antenna has 11 directors and covers the frequency range 174-225MHz for channels 6 to 11. It has a gain of 8 to 10.5dBd, depending on the particular frequency and a front-to-back ratio of 20 to 26dB. Its overall length is 2.25 metres.

To gain coverage down to channel 0 (or channel 2) it is usual to construct two Yagis on the one boom and couple them together. Such an antenna is the Hills 215 which covers channels 2, 7, 9 and 10 or the Hills 3-5/0 which covers from 0 to 11 inclusive. Such antennas are, at best, a compromise. It is very difficult to obtain usable gain together with a flat response and good front-to-back ratio for all channels.

Resonance required

That such antennas do give reasonable results is a tribute to the designer but one point can be emphasised. No physical rules have been broken. To gain this frequency coverage it is necessary to have at least one element in the antenna which resonates at close to a particular frequency in the total range. The reflector for example, is always cut to be resonant within the channel space of the lowest to be received.

In practical terms, for an antenna which covers channel 0, the reflector must be a little over three metres long, to resonate at about 49MHz. If your antenna is an older design which covers the range down to channel 2 the reflector will be about 2.2 metres long and thus the gain will be well and truly deficient for channel 0. The result will, at best, be a picture which is prone to lose sync and subject to "pulling" at the top, due to the sharply curtailed low frequency response. More likely, the result will be a snowy picture and one which is unwatchable.

Remember also that if the antenna reflector is cut for channel 2, the polar response will be far from ideal for channel 0. So even if you have reasonably ghost-free reception of channel 2, you could easily be plagued with ghosts on channel 0, even though, in Sydney at least, it is radiated from the same mast.

(To be continued)

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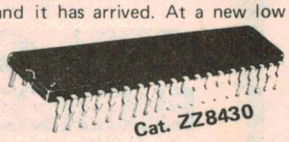

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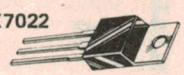

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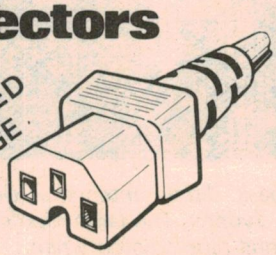
IEC Cable Connectors

NEW INCREASED RANGE



Most imported equipment these days now uses IEC-320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains-powered projects, to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords.
We have them in straight entry, left and right entry with and without standard 240V mains moulded plug. Each cord is a generous 2 metres long and is rated at 7.5 amp continuous. They are only available in grey.

Cat. No	Description	Price
PS4302	LINE CORD STRAIGHT ENTRY - 2M	$3.95
PS4304	LINE CORD R/HAND ENTRY - 2M	$3.95
PS4305	LINE CORD L/HAND ENTRY -2M	$3.95
PS4306	LINE CORD STRAIGHT ENTRY WITH 240V PLUG - 2M	$4.95
PP2302	IEC 320 CHASSIS PLUG	$2.95

EXPERIMENTER BREAD BOARDS

FROM

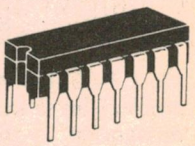
3.45

Cat. PB8810 WBDN 100 holes $3.45
Cat. PB8812 WBTN 640 holes $10.95
Cat. PB8814 WB2N 840 holes $16.95
Cat. PB8816 WB4N 1680 holes $29.50
Cat. PB8818 WB6N 2420 holes $45.00

el cheapo LM3900!!

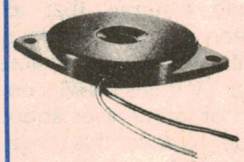
That's right, a pin-for-pin equivalent to the popular LM3900 for only 25 cents! We have heaps of LM 3401 (made by National Semiconductors). 14 pin plastic DIL IC's. The LM3900 normally sells for around a Dollar. NOW you can have 4 for a Dollar! (Minimum buy 4 pieces)

Cat. ZL3901
Quad OP-amp in a 14 pin DIL package —
ONLY 25 cents each



EA freezer alarm

Piezo Audio Indicator
We have the piezo audio alarm for this project. Small loud and low cost.



Cat. AB3440

$1.95

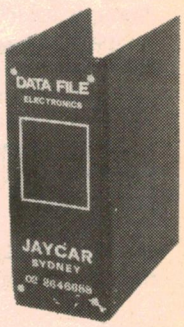
MAGAZINE BINDER

LOW IMPORT PRICE

$4.95

Quality

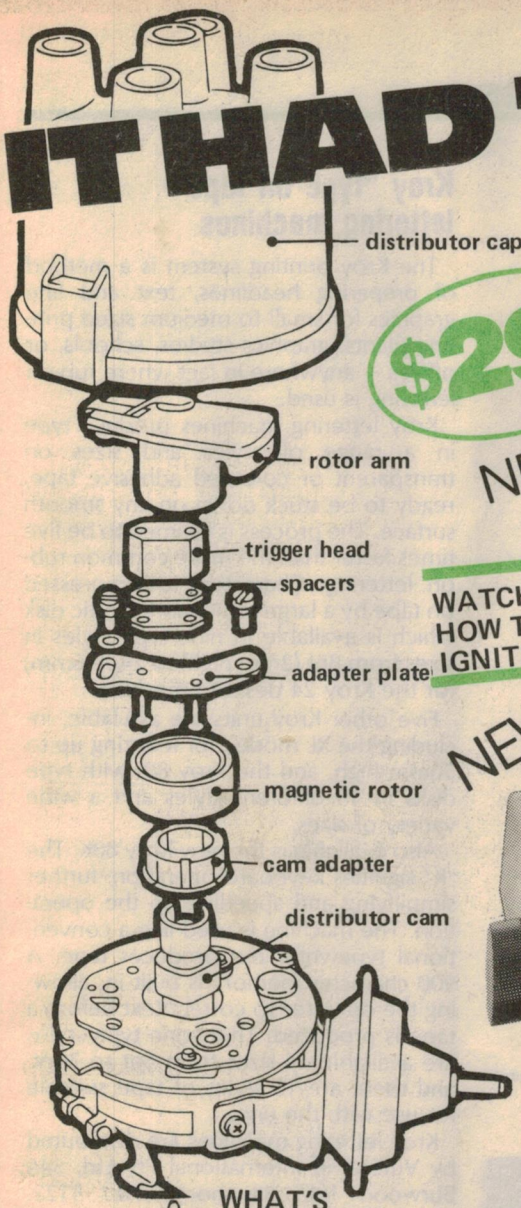
4 up $4.50 each



Keep your precious (and expensive) magazines in order for easy references. Smart blue colour with gold lettering. Heavy gauge and richly chromed metal fittings. Cat. BB7000

Cat. No.	DESCRIPTION OF KIT	Ref.	PRICE
KA1300	FUZZ BOX COMPLETE	EA 1/81	$ 19.50
KA1320	LE GONG	EA 3/81	$ 13.95
KA1346	PC BIRDIES SHORT FORM	EA 5/81	$ 14.95
KA1370	PHOTON TORPEDO	EA 9/81	$ 29.50
KA1400	METRONOME	EA 1/82	$ 16.95
KA1402	EPROM PROGRAMMER	EA 1/82	$ 59.00
KA1406	CUDLIPP CRICKET SHORT FORM	EA 2/82	$ 12.50
KA1408	DIGITAL STORAGE CRO ADAPTOR	EA 2/82	$110.00
KA1430	VOCAL CANCELLER	EA 4/82	$ 19.50
KA1432	VOX RELAY SHORT FORM	EA 4/82	$ 14.50
KA1450	GUITAR BOOSTER	EA 6/82	$ 14.50
KA1452	SUBWOOFER MOSFET AMP	EA 7/82	$ 79.00
KA1454	SUBWOOFER ENCLOSURE	EA 8/82	$ 79.00
KA1476	STEREO SYNTHESISER SHORT FORM	EA 9/82	$ 39.50
KA1478	STEREO SYNTHESISER COMPLETE	EA 9/82	$ 49.50
KA1482	POWER UP KIT COMPLETE	EA 11/82	$ 39.50
KA1484	SUPER SIREN SHORT FORM	EA 11/82	$ 5.00
KA1490	BOGGLE GOGGLES	EA 12/82	$ 9.50
KA1492	PH METER LCD	EA 12/82	$ 69.00
KA1494	PROBE FOR PH METER WITH BUFFER		$ 69.00
KA1498	AM WIDEBAND TUNER	EA 12/82	$249.00
KA1500	LED HEAD SHORT FORM	EA 1/83	$ 9.95
KA1510	STEREO SYNTHESISER SHORT FORM	EA 4/83	$ 11.95
KA1515	ALIGNMENT KIT AM TUNER	EA 3/83	$ 7.95
KE4050	50 WATT AMP MODULE	ETI 480	$ 23.00
KE4052	100 WATT AMP MODULE	ETI 480	$ 27.00
KE4064	PREAMPLIFIER MODULE	ETI 480	$ 30.00
KE4090	GENERAL PURPOSE PREAMPLIFIER	ETI 445	$ 7.99
KE4092	AUDIO LIMITER	ETI 446	$ 12.00
KE4094	BALANCED MICROPHONE PREAMPLIFIER	ETI 449	$ 5.50
KE4105	CAR ALARM	ETI 330	$ 29.50
KE4205	LED LEVEL METER	ETI 458	$ 59.00
KE4206	MC MOVING COIL PREAMPLIFIER	ETI 478	$ 26.50
KE4207	MM MOVING MAGNET PREAMPLIFIER	ETI 478	$ 19.50
KE4210	MOSFET AMPLIFIER	ETI 477	$ 59.00
KE4220	150 WATT MOSFET AMPLIFIER	ETI 499	$ 79.50
KE4222	150 WATT MOSFET PREAMPLIFIER	ETI 498	$ 39.50
KE4225	BRIDGING ADAPTOR	ETI 479	$ 9.95
KE4405	+/– 15 VOLT POWER SUPPLY	ETI 581	$ 17.50
KE4410	POWER SUPPLY 13.8 VOLT/10 AMP	ETI 160	$ 79.50
KE4505	SOUNDBENDER SHORT FORM	ETI 492	$ 24.50
KE4552	UHF CONVERTOR	ETI 735	$ 32.50
KE4554	VIDEO MODULATOR	ETI 760	$ 12.99
KE4560	LOW OHMS METER	ETI 158	$ 29.50
KE4570	POWER SUPPLY 0 - 30 VOLTS 1 AMP	ETI 162	$ 49.50
KE4600	MODEM SHORT FORM	ETI 644	$169.00
KE4602	MODEM COMPLETE	ETI 644	$189.00
KJ6502	SYNTOM DRUM SYNTHESISER KIT		$ 36.50
KJ6508	CHORUS GENERATOR KIT		$ 69.95
KJ6510	SHORT FORM IONISER KIT		$ 14.50
KJ6511	FULL IONISER KIT		$ 29.50

IT HAD TO HAPPEN



$29.95

NEW

A professionally-engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall-effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:
- HALL EFFECT TRIGGER HEAD
- MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
- OVER 6 CAM-LOBE ADAPTORS
- OVER A DOZEN DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
- OTHER HARDWARE (i.e. SCREWS etc.)
- YOU CAN REMOVE THIS SYSTEM AND RE-EQUIP YOUR CAR WITH THE ORIGINAL
- BREAKER POINTS WHEN YOU SELL THE CAR!
- AS EASY TO INSTALL AS A SET OF POINTS!
- INSTRUCTIONS (SIMPLE-TO-FOLLOW) INCLUDED!

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
We expect this kit to sell well. To ensure that you receive one, check with us early!
Cat. KJ6655

WATCH FOR NEWS IN "ELECTRONICS AUSTRALIA" TO SHOW YOU HOW TO ADAPT THIS KIT TO YOUR TRANSISTOR ASSISTED IGNITION — SIMPLE!!

NEW

80CPS Matrix Printer

ONLY $699

Magnificent 80 Character/Second Matrix Printer! — WITH GRAPHICS CAPABILITY.
INCREDIBLE PRICE BREAKTHROUGH!!
We DARE you to compare with other units selling for well over $900!!
WHERE ELSE will you buy an 80 column (142 compressed mode) printer for under $700? Check the specs below and you must agree!!

FUNCTIONAL SPECIFICATIONS

Printing method:	Serial impact dot matrix
Printing format:	Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field Semi-graphic (character graphic) — 7 x 8 dot matrix Bit image graphic — Vertical 8 dots parallel, horizontal 640 dots serial/line
Character size:	2.1mm (0.083")- W x 2.4mm (0.09")- H/7 x 8 dot matrix
Character set:	228 ASCII characters, Normal and italic alpha-numeric fonts, symbols and semi-graphics
Printing speed.	80 CPS, 640 dots/line per second
Line feed time:	Approximately 200msec at 4.23mm (1/16") line feed
Printing direction:	Normal — Bidirectional, logic seeking Superscript and bit image graphics — Unidirectional, left to right
Dot graphics density:	Normal — 640 dots/190.5mm (7.5") line horizontal, Compressed characters — 1,280 dots/190mm (7.5") line horizontal
Line spacing:	Normal — 4.23mm (1/16") Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216")
Columns/line:	Normal size — 80 columns Double width — 40 columns Compressed print — 142 columns Compressed/double width — 71 columns The above can be mixed in a line
Paper feed:	Adjustable sprocket feed and friction feed
Paper type:	Fanfold. Single sheet. Paper width — 101.6mm (4") to 254mm (10")
Number of copies:	Original plus 3 copies by normal thickness paper

MECHANICAL SPECIFICATIONS

Ribbon:	Cartridge ribbon (exclusive use), black
MTBF:	5 million lines (excluding print head life)
Print head life:	Approximately 30 million characters (replaceable)

INTERFACE SPECIFICATIONS

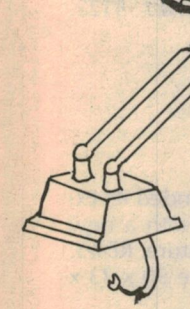
Interface:	Standard Centronics parallel
Data transfer rate:	4,000 CPS max.
Synchronization:	By external supplied STROBE pulses
Handshaking.	By ACKNLG or BUSY signals
Logic level.	Input data and all interface control signals are TTL level

SUPPLIED WITH 48 PAGE MANUAL

AND 13 DIFFERENT PRINTING MODES
e.g. normal, condensed, enlarged, emphasised, underlined, italic, etc. And remember — GRAPHICS as well!

CALL IN NOW FOR A DEMO!

Cat. YM2400



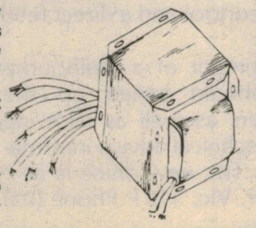
WHAT'S UP DOC? Low Cost

Are the "rabbit ear" antennas on the back of your portable TV broken? You know those ones that are telescopic and have ball-swivel joints.
We have genuine 'HMV' factory spares that will fit other TV's Apparently they are almost industry-standard components.
Each unit comes with a short length of lug-terminated 300 ohm ribbon.
We have a small job lot available at only $7.95 each.
ONLY 220 SETS AVAILABLE.
Cat. AA2005 **$7.95**

COMPUTER TRANSFORMER BARGAIN

$24.50

SAVE $5.00
WAS $29.50
Cat. MM2020



We have secured a quantity of a power transformer at a never-to-be-repeated price. This unit is ideal as the basis of an S-100 power supply, but can be used for many other computer or general power supplies.
SPECS: Primary 240V AC — Secondary 1: 15VAC 2 amp — Secondary 2: 15VAC 2 amp — Secondary 3: 8VAC 8 amp.
A typical DC supply could be ±15V DC @ 1.5A & 5V DC @ 8 A or ±12V DC @ 2A & 5VDC @ 8A. This transformer would normally sell for around $50 — Brand new stock.

SEE THE OTHER JAYCAR ADS IN THIS MAGAZINE FOR ADDRESS DETAILS

New Products...

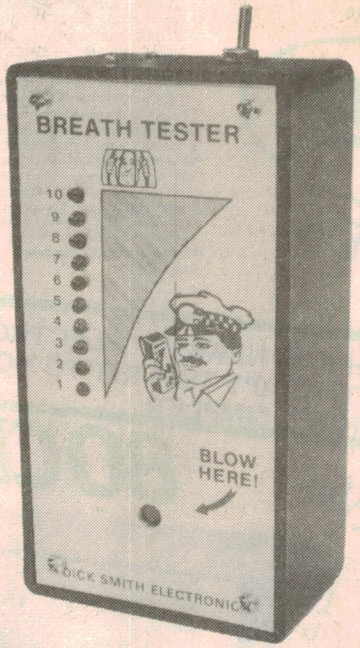
Product reviews, releases & services

New kits from Dick Smith Electronics

Dick Smith Electronics has produced an excellent kit of the EA Electronic Roulette wheel complete with a baseboard, with all components, and mounting hardware, even a connector for the 9V battery.

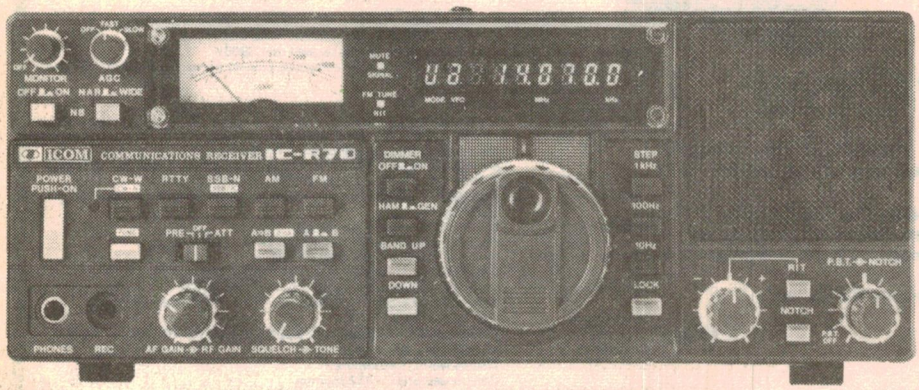
A feature of the kit is high standard of the 162 x 250mm front panel, produced in black with lettering and the wheel itself silk-screened in red. Component placement and orientation are clearly marked, so the kit should be ideal for the beginner. As a bonus a 297 x 420mm playing board and full instructions on how to play are included. For just $29.95 the DSE version of the roulette wheel kit seems a bargain.

Also from Dick Smith is the Breath Tester kit, supplied with a plastic utility box and silk-screened aluminium front panel in blue, and all components, including five green LEDs (safe) and five red LEDs (over the limit). The kit is provided with a connection for a plugpack, but also includes a car cigarette lighter connector so that it can be used in the place it is most needed. The connector is included in the $29.95 price, and is a convenient means of powering other appliances from the car's electrical system.



Both the deluxe Electronic Roulette wheel and the Breath Tester kit are available from Dick Smith stores throughout Australia and in New Zealand.

Australian branch office for Icom



Icom, the well-known Japanese manufacturer of communications equipment has opened a branch office in Melbourne to answer the increasing demand for its products in Australia. Communications products available include marine, commercial and amateur equipment for the HF, VHF and UHF bands, supplied and supported directly by Icom Australia Pty Ltd.

New gear introduced with the opening of the Australian branch includes the IC-R70, a communications receiver covering channels from 100kHz to 30MHz. Features of the receiver include microprocessor control and a direct feed mixer.

Icom's establishment of a Melbourne branch office should speed up the devivery of orders as well as allowing ready access to technical advice information and service. The new office is at 7 Duke St, Windsor, Vic, 3181. Phone (03) 529 7582.

Kroy "type on tape" lettering machines

The Kroy printing system is a method of preparing headlines, text and line graphics for small to medium sized printing plants, graphics studios, schools, or offices – anywhere in fact where rub-on lettering is used.

Kroy lettering machines produce type in a range of styles and sizes on transparent or coloured adhesive tape, ready to be stuck down on any smooth surface. The process is claimed to be five times faster than the more common rub-on lettering. Characters are impressed on tape by a large removable plastic disk which is available in nine type styles in sizes from 8pt (2mm high) to 24pt (6mm) for the Kroy 24 desktop machine.

Five other Kroy units are available, including the XL model, for lettering up to 50mm high, and the Kroy 80, with type disks in 19 different styles and a wide variety of sizes.

Also available is the new Kroy 80K. The "K" signifies keyboard operation, further simplifying and speeding up the operation. The machine is used like a conventional typewriter but produces tape. A 900 character memory is built in, allowing the operator to correct text before a tape is produced. Thirty-one type styles are available, in sizes from 8pt to 36pt, and there are 16 styles of tape suitable for use with the unit.

Kroy lettering machines are distributed by Vuestamp International Pty Ltd, 546 Burwood Rd, Hawthorn, Vic. 3122. Phone (03) 818 0268.

Miniature storage battery from Chloride Australia

Chloride Australia has expanded its Exide RELB family of batteries with a new 4V, 3A/hr model, the miniature RE4-3. Dimensions of the battery are 90 x 33 x 60mm.

The RELB designation stands for recombination electrolyte lead battery, a totally sealed design that does away with the need for vents and screwtops. There is no liquid electrolyte in the battery, so it can be mounted in any orientation, and is said to work equally well if used only occasionally as a back-up supply, or in applications which subject it to repeated heavy drain and frequent recharging.

For further information contact Chloride Australia, 147-149 Woodpark Rd, Smithfield, NSW, 2164, or branches in other capital cities.

GIVE AWAY SALE

Prices so low, they'll astonish you

SUPER POWER DIODES

Scoop purchase of these 100V/250A power diodes. Type 70U10P. Normally selling for $29.00 each, we are giving them away for only:

$12.00 each
5 for $55.00

Top quality from International Rectifier (IR)

Rheostat: 150ohm/25W

Massive saving on these ceramic body ¼" shaft rheostats. Normally $12.00 each. Look at the savings.

$1.00 each

240VAC Motor

Scoop purchase of these open frame motors. Approx 6,000 rpm.

$2.00 each were $15.00

NICAD BATTERIES GET THE CHOP!!

We want to clear our stocks of high quality Yuasa and SAFT nicad batteries. Get in for your chop!!

Yuasa AA 500mAH	$2.30 10 for $21.00
SAFT Sub-C 1.2AH	$4.50 10 up $41.00
SAFT Type C 2.0AH	$4.95 $45.00
SAFT Type D 4AH	$8.50 10 for $76.00
SAFT D plus ½ 7AH	$14.50

Professional Drills at a Hobbyist Price!!

If you need a drill that is a tool and not a toy, these superbly engineered precision drills from AppliCraft will be your choice. Manufactured in France to the highest standards, they provide the torque and speed you need for PCB drilling and other demanding hobbyist tasks.

High Speed Model

Precision drill with 3 interchangeable collettes for sizes from .1mm to 2.4mm. 10,5000 RPM. 9-16V. 160g. Ref 20,000

$16.50

Deluxe Drill Set

Includes Drill, stand and flexible drive complete with 30 accessories in carrying case. Includes the High Speed Drill shown above and the Drill Stand below. Ref 20,100

$69.00

Drill Stand for above

Suitable for precision drilling of printed circuit boards. Ref 20,400

$12.50

Flexible Drive Shaft

Suits High Speed Model Drill. Complete with chuck and collettes. Ref 20,700.

$10.95

NEW! Precision High Speed Drill

This ultra high speed model will really get the job done fast!! Capacity to 3.5mm, 9 to 18 Volts. 20,000 RPM. A really precision instrument, but look at the price!! Ref 40,000

$24.00

Drill Set

This fantastic drill set includes the high speed precision drill shown above plus a wide range of 15 accessory drills, brushes and grinders. Ref 40,100

$35.95

Bridges Under wholesale price!

High quality 400V/10A bridge rectifiers from International Rectifier (IR). Normally $3.00. We've chopped the price!!

$1.20
10 for $10.00

Semiconductor Bargains

Transistors

Type	Qty	Price
NPN & PNP	50 ASSTD	$1.50
BC107	NPN 10	$1.50
BC207	NPN 10	90¢
BC332	NPN 10	90¢
BC547	NPN 10	90¢
BC557	PNP 10	90¢
BC548	NPN 10	$1.40
BC558	PNP 10	$1.40
BD283, 281, 357, 377	NPN 4	$1.30
BD282, 283, 281, 357, 377	2ea (10 total)	$3.00
BD537	NPN 10	$2.00
BD135	NPN 5	$3.00
TIP29B	NPN 10	$3.50
2N3055	NPN 10	$7.75
2N3643	NPN 10	$2.95
2SB367	PNP 5	$3.50

THUMBWHEELS FOR ⅓ NORMAL COST!!

High quality UK STOLEC 10 position single pole thumbwheel switches slashed for this month only. These precision switches are in grey Dimensions 57mm (height) x 70mm deep x 15mm wide. Scoop price!!

5 FOR $10.00!!

NEON DISPLAY

6 Digit orange neon display (as used in pinball machines etc). From Cherry of Waukegan USA. 18mm characters, 160VDC. Normally over $30.00

$8.00
$6.50 10 up—

PLEASE NOTE: ALL OUR PRICES INCLUDE SALES TAX!!

SHERIDAN ELECTRONICS

164-166 Redfern St., Redfern NSW 2016.
Phone (02)699 6912, (02)699 5922
Mail Orders to Dept EA, PO Box 229
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Trading Hours:-
Mon-Fri.....9am-5.30pm
Thursday.....9am-7pm
Saturday....9am-12noon

Mail Charges:

$5.00-$9.99	$3.50
$10.00-$24.99	$4.00
$25.00-$49.99	$6.00
$50.00-$99.99	$7.00
$100.00 or over	$8.00

Note: We regret we cannot give quantity discounts on credit card purchases.

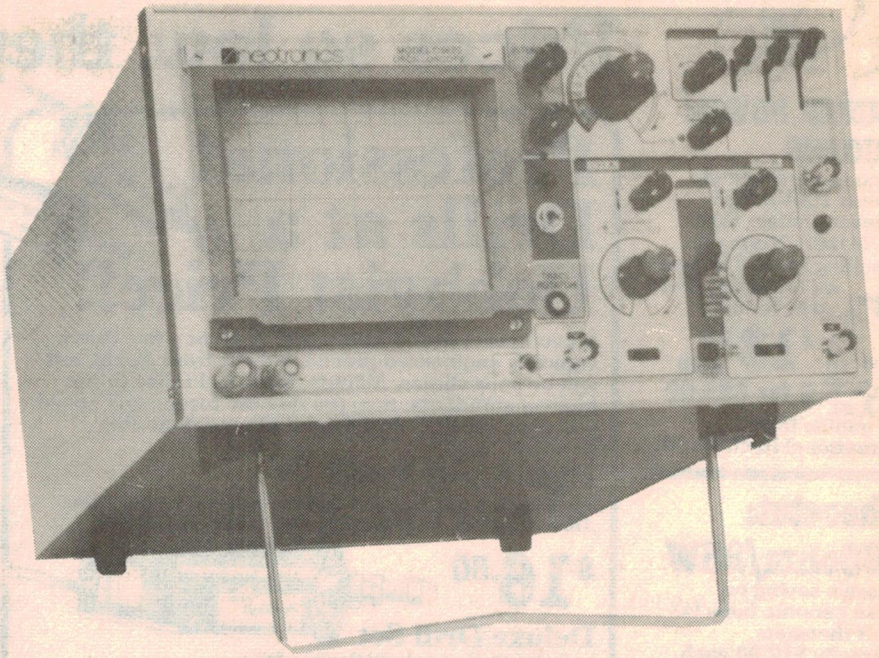
Credit Cards: We accept both BankCard and American Express

MINIMUM ORDER $6.00

ALL ENQUIRIES INCLUDE S.A.E.

Art Express 923 1499

Neotronics 20MHz oscilloscope



Sydney company Neotronics Pty Ltd has introduced a new general purpose oscilloscope, said to be suitable for both professional and hobbyist applications.

The Model OS620 is a dual trace oscilloscope with a bandwidth of 20MHz. Input sensitivity is quoted as 5mV/cm and trigger circuitry is included to allow video waveforms (for example) to be captured and expanded for viewing of line and frame synchronisation signals, or other complex signals.

A feature of the OS620 is a component test circuit and front panel terminals which allow single components or components in circuit to be tested. Used with a 2mA test signal from the CRO, this circuit allows component faults to be diagnosed. For further information contact Neotronics Pty Ltd, 314 Lower Plateau Rd, Avalon, NSW, 2107. Phone (02) 918 8220.

Scientific Electronics cuts power supply prices

Peter Lloyd, managing director of Scientific Electronics recently announced price cuts of up to 15% in his company's range of open frame switch mode power supplies.

Some imported power supplies were coming in at very competitive prices, he said, and his company was fully prepared to meet them head on.

His company's Australian designed and manufactured switch mode supplies, while meeting the import prices, offered equivalent or better performance, in a much smaller package and were fully backed by a five year guarantee. The imported supplies were also at a disadvantage to the Australian made product, according to Mr Lloyd, because it was difficult or impossible for the suppliers to provide the same depth or speed of technical back-up and service.

As he put it Australian design and manufacturing expertise could compete with any in the world, as clearly demonstrated by the release of a 200kHz switching supply, a development which put Scientific Electronics among world leaders in the manufacture of high technology power supplies.

For further information contact Scientific Electronics, 6 Holloway Drive, Bayswater, Vic. Telephone (03) 762 5777.

Insurance for Jaycar customers

Mail order customers are concerned about the possible risk of their goods going astray in transit. Basically, the customer bears the risk once the goods are despatched by the kitset supplier. And while some people may be philosophical about the possible loss of a small kit, a kit worth several hundred dollars is quite another matter.

Recognising this, Jaycar Pty Ltd have announced that they are providing free insurance for all orders of $200 or more which are despatched by road freight or registered post.

Shortwave Scene

by Arthur Cushen, MBE

Political chaos in international broadcasting

An increase in jamming and political interference in the orderly observance of frequency allocations could be a major deterrent to the expansion of international broadcasting.

Two recent statements by BBC officials have awakened listeners to the chaotic situation in international broadcasting and the meeting of the World Administrative Radio Conference next year may be mainly concerned with deliberate harmful interference to shortwave broadcasting. Douglas Muggeridge, Managing Director of BBC External Broadcasting said that many people did not seem to be aware that the jamming was a world-wide problem. Perhaps, because it is more of a political than a technical problem there may be a solution, but if there is not then it is difficult to see how any order can be brought out of the chaos that exists at certain times of the day due to jamming.

Keith Edwards, Chief Engineer of BBC External Service said that jamming was affecting more and more listeners all over the world. In Europe during the evenings up to 86% of the frequencies in the 17MHz band were affected. In the 9MHz band again almost 80% of the frequencies are affected by jamming and in the 7MHz band up to 80% of the frequencies are affected. The jamming is more intense in Europe but is a problem world-wide. Recent surveys show that in South Africa the 15MHz band had more than 70% of the frequencies covered with jammers and in Japan the figure was 30%. In the 9MHz band Japanese listeners found 40% of the band affected, and in Canada more than 50% of stations were covered by interference during the peak evening listening period. Keith Edwards said that it was essential that people around the world should know of the situation and world opinion should be mobilised as the problem could only be solved through political discussions. The BBC is jammed when broadcasting in Russian, and so has added more transmitters, and the whole problem is being accentuated as more jammers chase more transmitters, with the resulting discouraging effect on shortwave listening.

LATIN AMERICAN NEWS

Signals from Central and South America are providing very good reception during the evening listening period in the 49 and 60 metre bands, and this summary covers some of the most interesting signals which have been received, and is by no means a complete survey of reception.

BRAZIL: Radio Universo, Curitiba 6020kHz heard on a Sunday with gospel programs at 0830 and at the same time their other channel, 9545kHz, has been received but suffers interference from the Solomon Islands Broadcasting Corporation. Several Brazilian stations operating 24 hours a day have been heard at this time including Radio R.A. Voz d'Oeste on 4775kHz and Radio Maua on 5055kHz.

COLOMBIA: Radio Macarena on 5972kHz verifies reception with a letter and tourist booklet in English on Colombia; this new station has the call HJHZ and uses 5kW opening at 0900UTC. The address is Ap. Aereo 2484, Villavicencio, Colombia.

COSTA RICA: Radio Impacto, Box 497, San Jose is a new station on 6150kHz which is well received up to 0830UTC when the frequency is blocked by ABC Melbourne. The station has announcements in both Spanish and English and was first reported by Chris Davis of Featherston, NZ.

ECUADOR: Radio Tarqui has made a frequency change to 4977kHz and has been heard around 1045 with Spanish announcements. At 1100 the Ecuadorian National Anthem is played followed by full station identification. Radio Tarqui broadcasts from Quito, and formerly operated on 4970kHz.

NEW FREQUENCIES

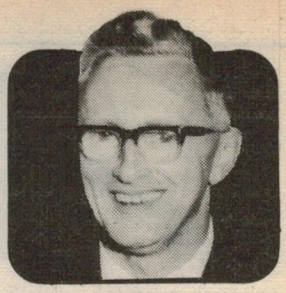
CZECHOSLOVAKIA: Radio Prague advises that they are using 250kW on 11800kHz, while the new 500kW transmitter is also scheduled to transmit to North America at 0100-0157 and 0300-0357UTC in English on the frequencies of 5930, 7345, 9540, 9630, 9740, 11800, 11950 and 11990kHz.

The broadcasts in English to the Pacific at 0730-0800 and 0830-0900UTC are on 11855, 17840 and 21705kHz, while on Saturday and Sunday an additional transmission at 0900-0930UTC is carried on the same frequencies.

DENMARK: Radio Denmark using the 50kW transmitter broadcasts only in Danish except for short English identification at the opening of the transmission. Each broadcast is generally 50 minutes long. The broadcast at 0900-0950UTC is on 25850kHz and at 1000-1050 on 17770kHz and at 1100-1150 on 17770kHz reverting to 25850kHz at 1200 and 1300UTC.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

Shortwave Scene



by Arthur Cushen, MBE

Political chaos in international broadcasting

An increase in jamming and political interference in the orderly observance of frequency allocations could be a major deterrent to the expansion of international broadcasting.

Two recent statements by BBC officials have awakened listeners to the chaotic situation in international broadcasting and the meeting of the World Administrative Radio Conference next year may be mainly concerned with deliberate harmful interference to shortwave broadcasting. Douglas Muggeridge, Managing Director of BBC External Broadcasting said that many people did not seem to be aware that the jamming was a world-wide problem. Perhaps, because it is more of a political than a technical problem there may be a solution, but if there is not then it is difficult to see how any order can be brought out of the chaos that exists at certain times of the day due to jamming.

Keith Edwards, Chief Engineer of BBC External Service said that jamming was affecting more and more listeners all over the world. In Europe during the evenings up to 86% of the frequencies in the 17MHz band were affected. In the 9MHz band again almost 80% of the frequencies are affected by jamming and in the 7MHz band up to 80% of the frequencies are affected. The jamming is more intense in Europe but is a problem world-wide. Recent surveys show that in South Africa the 15MHz band had more than 70% of the frequencies covered with jammers and in Japan the figure was 30%. In the 9MHz band Japanese listeners found 40% of the band affected, and in Canada more than 50% of stations were covered by interference during the peak evening listening period. Keith Edwards said that it was essential that people around the world should know of the situation and world opinion should be mobilised as the problem could only be solved through political discussions. The BBC is jammed when broadcasting in Russian, and so has added more transmitters, and the whole problem is being accentuated as more jammers chase more transmitters, with the resulting discouraging effect on shortwave listening.

LATIN AMERICAN NEWS

Signals from Central and South America are providing very good reception during the evening listening period in the 49 and 60 metre bands, and this summary covers some of the most interesting signals which have been received, and is by no means a complete survey of reception.

BRAZIL: Radio Universo, Curitiba 6020kHz heard on a Sunday with gospel programs at 0830 and at the same time their other channel, 9545kHz, has been received but suffers interference from the Solomon Islands Broadcasting Corporation. Several Brazilian stations operating 24 hours a day have been heard at this time including Radio R.A. Voz d'Oeste on 4775kHz and Radio Maua on 5055kHz.

COLOMBIA: Radio Macarena on 5972kHz verifies reception with a letter and tourist booklet in English on Colombia; this new station has the call HJHZ and uses 5kW opening at 0900UTC. The address is Ap. Aereo 2484, Villavicencio, Colombia.

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Letters to the editor

Super 80 problems and solutions

Regarding a letter which appeared in "Information Centre", EA February 1983, I was interested to discover a fellow Super-80 builder who had encountered similar problems to those which I faced. I too, could not get the LED and relay to "pass the test", and resorted to putting in the remaining chips and hoping for the best! It then worked perfectly and has ever since, which suggests that this section of the technical manual be reviewed.

I also had the problem of characters changing on the screen after the computer had been on for more than about 15 minutes. I had several ideas ranging from faulty memory chips to failing refreshing circuitry, and decided to put my theories to the test. However, with the case lid removed, the fault refused to occur! It also vanished when I reduced my memory from 48K to 32K RAM.

This led me to the conclusion that the memory containing the screen map, which is directly adjacent to the regulators (on a 48K RAM Super-80) was overheating, especially with the case closed. Having established which RAM chip was "forgetting", I solved the problem by mounting it on top of a wire wrap socket which acts as a heatsink to the pins of the chip (simple!). Incidentally, extra heatsinking on the regulators failed completely, as I suspect the heat was transferred to the chip through the board (probably via its ground connection).

Yet another problem which I faced (having solved the previous one and begging to regain sanity), occurred following the installation of the deluxe character generator. The video page latch (U34) was forgetting which page it was supposed to be displaying, annoyingly changing to display a random page, (especially when the computer received a knock). The problem lay in the fact that the deluxe character generator (including U34) is installed on wirewrap sockets, into existing IC sockets. This arrangement is top-heavy, and tends to work loose. This fault can easily be prevented by occasionally giving the whole unit a firm depression back into its sockets.

I hope that this information may be of help to your readers, as it is all too easy to bypass the obvious and become too technical!

The characters appearing on my screen were "(" characters (ASCII 40), in place of spaces (ASCII 32), as well as many other changes – always a difference in ASCII code of 8. Thus it became obvious that the fourth chip (row 3) in the relevant bank of memory, was changing, or "forgetting".

P. Delany,
Ormond, Vic.

Compliments on the AM tuner project

Reference to my letter entitled "High Quality AM Radio Reception" published on page 90 of the March 1981 issue. I have had in operation for the past three months or so your "Playmaster Hifi AM Tuner" and am writing to compliment you on such a fine performer. It would be hard to find any other AM tuner, for home construction, which would equal the performance of your design.

Construction was relatively straightforward, considering the overall complexity, although forming and soldering an interminable number of links in the digital dial was rather tedious towards the end. Perhaps this board could be redesigned as a double-sided one, and pins could be inserted to couple the various links together.

A friend, after listening to the tuner, was as enthusiastic about it as I am, although his only comment on being shown the works was: "good grief!"

R. Tregea,
Pennant Hills, NSW.

Reviews of popular records wanted

First of all, congratulations on a magnificient magazine. During the two or three years I have been reading it regularly, I have learnt an immense amount about electronics.

However, if I had been relying on your publication to learn about popular music, I'd still be listening to my old Abba records. The only edition of late was November 1982. Only two albums of interest were reviewed, and one of those is nearly 12 months old. Similar criticism can be applied to the singles reviewed.

I am sure your younger readers would appreciate a coverage of similar magnitude to that give to classical records. Perhaps soliciting contributions from readers is an easy solution.

Hope you will give this due consideration, and again, keep up the good work.

D. Cornford,
Turramurra, NSW.

Comments on the proposed Communications Act

Your Forum column about the new broadcasting act was very interesting, particularly your views on which receivers would be licenceable and which would not. I tend to disagree with you as to which receivers would be exempt; the position of the word "only" in the clause seems to exclude from the exemption any receiver which offers any feature, intentional or accidental, other than the reception of public broadcast transmissions.

Thus receivers which would appear to be liable for licensing would be those designed or intended to:

- receive broadcast programs other than public broadcasts, even where these occurred in a band allocated for public broadcasting;
- receive any transmission, including interference, natural or man-made, in any band including those allocated for public broadcasts;
- offer any feature additional to the reception of public broadcast programs, as for example a television receiver accepting "wired" signals from a video recorder, or a portable radio receiver having cassette recording or replaying facilities. It would also appear that physical or aesthetic features such as light weight, pleasant appearance, etc, would make the receiver liable for licensing.

It may be possible (although I doubt it) to design a receiver which would fall within the limits of the exclusion-from-licensing clause; as the act is worded, it would appear that the provision of this feature would render the set licenceable.

G. Mayman,
Dover Gardens, Vic.

COMMENT: Congratulations. You're being even harder to get on with than we were. But at least you are prepared to regard seriously a law that, if enacted, could only be a bad law.

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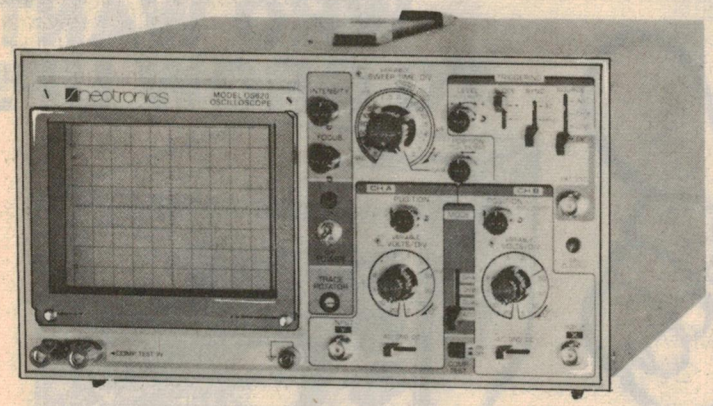
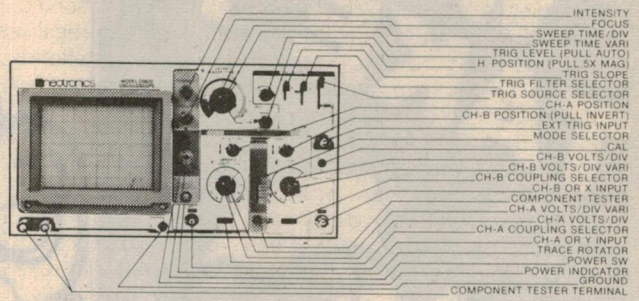
MORE SCOPE.. LESS MONEY.





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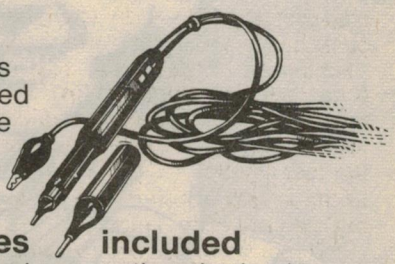
$571.30 INC. TAX

Probes included in price



Price Breakthrough

The Neotronics Model OS620, is a powerful 20MHz dual trace Oscilloscope with performance and features normally found on scopes costing $200-$500 more. We sell at lower profit margins and import directly from the manufacturer. You reap the benefit!!

Compare the Features

The Neotronics OS620 is a precision measuring instrument. The tube is a 150mm flat screen/ internal graticule type with 2kV acceleration potential. The bandwidth is a full 20MHz on both channels. The others offer round faced tubes, plastic graticules, less bandwidth, yet cost more! By importing directly we offer you the best value on the Australian market.

Built-in component tester

The component tester allows you to make full use of the OS620. With no additional test gear, you can check resistors, capacitors and zeners diodes as well as trouble shoot solid state circuits. Testing signals are available via the COMP. TEST terminals.

Probes included

With most scopes, the price is a bit of a con. Most users will need a set of probes. These are sold as very expensive 'extras' – often costing over $70.00 a pair (we think this is a bit like selling a car and then saying it's extra for the tyres!). The Neotronics OS620 comes complete with a pair of high quality probes.

	Neotronics OS620	Hitachi V-152F	TRIO 1560 AII
Bandwidth	20MHz	15MHz	15MHz
Flat screen CRT with internal graticule	Yes	No	No
Probes	Included	$28.75 each	$39.50 each
Component Tester	Yes	N/A	N/A
Price (inc tax)	$571.30	$660.06	$626.75
Price with two probes	**$571.30**	**$717.56**	**$705.75**

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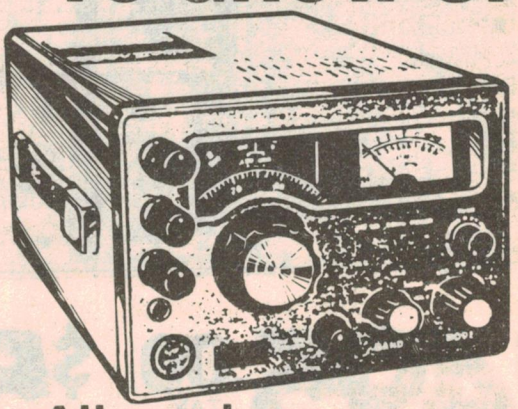
IDEAL NOVICE SET FOR THOSE WHO WANT TO GROW UP!



Economy All mode SS105 TRANSCEIVER

Here's THE transceiver that's not only fantastic value for the novice..... but it grows with you!

With everything the novice needs - including a low, low price tag - the superb SS105 transceiver gives you something pretty rare these days: a chance to get 'on the air' without breaking the bank!

And you can even add FM (for transverting) later on - just by adding the low-cost FM boards! Just imagine: FM in a transceiver so low in price!

Here's what it's got:

- 3.5 to 28MHz band coverage
- LSB, USB & CW emission (FM optional)
- 13.5V DC operation: take it anywhere (great mobile/emergency set!)
- Plug-in pcb construction for easy servicing if required.
- Complete with manual with full circuit diagram & alignment data, parts lists, etc.

Hurry ..... limited stock of this outstanding transceiver. Options see facing page. **Cat D-2900**

GREAT VALUE

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- We are proud of our Amateur Radio Department and back every piece of equipment we sell with our exclusive 7 day satisfaction guarantee.

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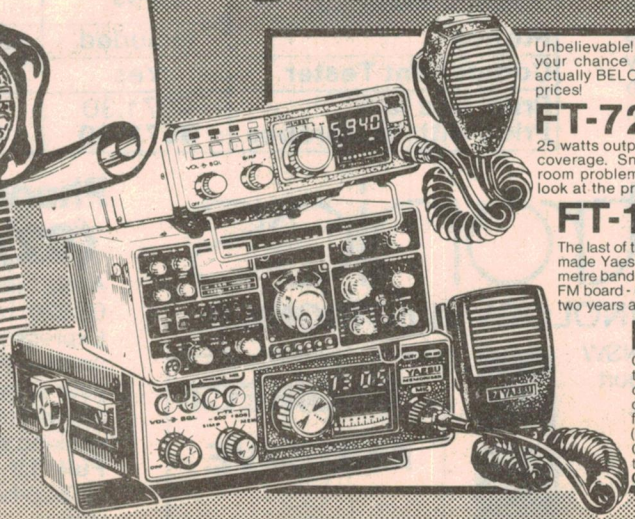
2 metre transceivers below cost!

Unbelievable! If you want a top quality Yaesu transceiver here's your chance to grab a real bargain! Last few left in stock are actually BELOW COST! Hurry - they won't last long at these crazy prices!



FT-720 RVH

25 watts output with full PLL 144-148MHz band coverage. Sneaky design can 'split apart' for room problems. Sold for $450 back in 1982 .... look at the price now! **Cat D-2890**

ORIGINALLY ~~$450~~

ONLY $275

FT-101 ZFM

The last of the fabulous '101's - the transceivers that made Yaesu famous with amateurs! Full 160 to 10 metre band coverage (non-warc) and this one has an FM board - great for 10m or transverting. Was $825 two years ago.... **Cat D-2872**

ONLY $765 ~~$825~~

FT-227 RB

One of the most popular two metre transceivers ever made. Ten watts output, ideal for working around the city (great with repeaters!) and has four memory channels to choose from (in addition to the PLL scanner). Originally $379... Here's your chance to get into two metres really cheaply. **Cat D-2891**

ORIGINALLY ~~$379~~

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Want to update your SS105 Transceiver?

Noise Blanker

That really works! Minimise most types of pulse noise. Highly recommended for maximum transceiver capability.
Cat D-2901 **$29.95**

FM receive IF unit

FM receive circuit to convert 9MHz to 455kHz and amplify and detect signals; equipped with a built-in squelch circuit.
Cat D-2902 **$59.95**

FM transmit IF unit

IF circuit for FM transmit, consisting of a modulation circuit & IF amplifier **Cat D-2903** **$34.95**

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Plug-in pcb to give 25kHz for accurate calibration. **Cat D-2904** **$34.95**

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NOW $139 **WAS $157.50**

Match your FT-707 into just about anything - even a piece of wet string! Complete with superb power & SWR meter, push-button operation and just plugs in to your 707 for power, Fantastic value (use with other rigs, too!) but once again - be warned: Extremely limited stock. Your local store may even have to order one for you. But it's worth it !
Cat D-2875

YAESU FV-707 VFO

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Full digitally synthesised VFO giving you unbelievable control over your 707. Slim-line construction, ideal for slotting underneath the rig. And if you thought the others were in short supply, these are scarcer'n hens' teeth. At our low, low price it's strictly first come, first served - while stocks last!
Cat D-2896

Very limited stock.

LANDLINE INTERFACE

PHONY PATCH

Legal Phone Patching could be just around the corner now third party is ok! Be ready for phone patching when it arrives with this superb kit - easy to build, really good results from your HF or VHF transceiver. As described in the June 83 Electronics Today Int.

Cat K-3054

ONLY $59.50

FTV-707 TRANSVERTER

Low-cost transverter for getting upstairs with your 707 - the economical way! Just plug in the module you want - and you're away.

Cat D-2876

ONLY $145

MODULES *for above transverter*

2 Metre Module Cat D-2877 **$149**

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70cm Module Cat D-2879 **$249**

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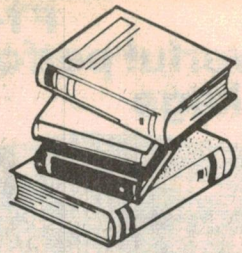
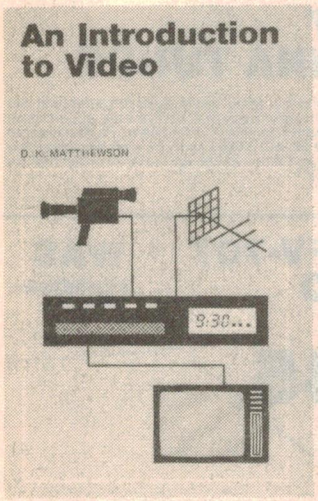
Books & Literature



Video for beginners



An Introduction to Video: By D. K. Matthewson. Published by Bernard Babani Ltd, London, UK. Soft covers, 87 pages, 110mm x 178mm. Illustrated with line drawings. ISBN 0 85934 075 9. Price $5.85.

The word video in this title is used in the most recent sense to encompass the domestic video recording scene; the video recorders themselves, cameras to go with them, and the various accessories, interconnecting leads etc.

The author's stated aim is ". . . to present, in as non-technical a way as possible, how a video recorder works, and how to get the best out of it. No knowledge of electronics is assumed or required."

In fact, the book is not aimed at the technically minded reader at all and the "how a video recorder works" bit should not be taken too seriously by those readers. More realistically, it is aimed at the potential purchaser of video equipment who suddenly realises that he needs to catch up on such things as the various systems (VHS, Beta etc), the things a VCR is supposed to do, how to use it with his particular TV set, the likely cost etc.

In this role the author does a very good job and manages to explain most of the points about the equipment without being sidetracked into deep technical discussions. The book starts off with a small group of questions and answers covering the most frequently encountered layman's queries. Then it goes on to talk about recorders, cameras, video discs, the various systems and even Videotext (Teletext).

The next chapter deals with features, specifications, bandwidth, signal-to-noise ratio, chroma noise, hue accuracy, signal levels, audio inputs and outputs, sockets, camera connectors, etc.

There is also a chapter on using the equipment, covering interconnections between units, maintenance and care, using video cameras, copying and editoring, copyright etc. The book finishes with a glossary of common video terms.

The only limitations, for the Australian reader, arise because the book is written for the UK market. Price structures, for example, have little meaning, while the implication that all TV receivers operate on UHF exclusively, does not apply in this country. Similarly, the discussion on Videotext is of little local interest.

But these are minor points, and readily recognised. For the reader at which the book is aimed it does a very good job. At the modest price asked it might well be regarded as essential reading for any prospective VCR purchaser before he throws himself on the mercy of a salesman.

Our copy from Technical Book and Magazine Co Pty Ltd, 289 Swanston St, Melbourne, Vic, 3000. (P.G.W.)

Radio and TV Handbook

1983 WORLD RADIO & TELEVISION HANDBOOK published by the World Radio & Television Handbook Company, Copenhagen, Denmark, 37th Edition 608 pages, soft cover, 146 × 228mm.

The World Radio & Television Handbook has been published from Copenhagen for 37 years. It was first conceived by O. Lund Johansen who published the Handbook in 1946 when it covered less than 100 pages. Today the World Radio & Television Handbook, covering more than 600 pages gives complete details of all the world's radio and television stations. They are listed in countries by continental groupings and then medium and shortwave stations are listed by frequency. The Australian, New Zealand and South Pacific section has been completely updated and rewritten thanks to collaboration by readers in Australia and New Zealand who have gone through the last World Radio & Television Handbook thoroughly to ensure that this section is as accurate as possible.

The Handbook has continued to expand its information and many new countries appear in the 1983 edition for the first time. In the section "Listen to the World", Lawrence Mange reviews many of the popular portable communication receivers which have taken the listening world by storm in recent months. These include the ICOM IC-R70, Sony ICF-6800W, Trio-Kenwood R-600, National Panasonic DR-31 and many more receivers from leading world manufacturers. The section gives background information needed when one is considering purchasing a new receiver. Other features sections include Yachting and Shortwave Radio, the High Fidelity Future of Shortwave and Mediumwave AM Radio. The Red Cross Broadcasting Service, Radio in Nicaragua etc – altogether 43 pages of interesting reading.

The World Radio & Television Handbook has long been regarded as the only directory of international broadcasting sold throughout the world. The United States Information Agency has put copies into its libraries in 71 countries so that those in third-world countries who cannot afford the book will have access to its informtaion. The Editor J. M. Frost, and Assistant Editor A. G. Sennitt, are to be congratulated on the painstaking work involved in compiling another excellent edition of the Handbook. Readers in Australia and New Zealand should find copies at their bookseller this month, or they can write to the sole New Zealand agent, Arthur Cushen, 212 Earn Street, Invercargill, New Zealand for further information. (A.T.C.)

Disassembly manual for the TRS-80

DISASSEMBLED HANDBOOK FOR THE TRS-80 Vol 3: by Robert M. Richardson. Soft covers, 260 pages, 218 x 280mm, spiral bound. Published by Richcraft Engineering Ltd, New York, 1981.

This volume is one of a series of five providing programs and information for users of the TRS-80 computer. The spiral bound format, typed pages and rather informal style notwithstanding there is a

wealth of information here on advanced assembly language programming, interface circuits and radio communications applications of the TRS-80.

Twelve chapters of the book provide examples of disassembler programs (written in Basic, but designed for speed of operation), programs for printer spooling, interrupt processing, analogue to digital and digital to analogue converters, morse code transmission and reception and radioteletype applications, among other subjects.

(Printer spooling is an example of multitasking, using the time taken by the mechanical movements of a printer to perform other processing in between printing each character.)

Each topic is presented as a tutorial supported by program examples and a series of questions and answers on each chapter is provided at the end of the book for self-teaching.

The topics covered are for the advanced computer user, and assume familiarity with Z80 assembly language. Earlier volumes in this series however cover TRS-80 ROM function calls and assembly language programming so the complete series would form valuable tutorial material. Seeing this third volume has whetted our appetite for more of the same.

The series (five volumes plus two more in preparation) is distributed in Australia and New Zealand by Northern Digital, PO Box 333, Charlestown, NSW, 2290. Phone (049) 43 8981. Unfortunately they didn't include the price in the information they sent us. (P.V.)

Thomson memories & microprocessors

MICROPROCESSORS AND MEMORIES. Published by Thomson-Efcis 1982. Soft covers, 148 x 209mm, 573 pages, illustrated with diagrams. Price $12.95.

This data book provides details of microprocessors, memory devices and peripheral controller chips made by Thomson-Efcis MOS Integrated Circuits Ltd.

The value of this book is mainly in the data sheets for Motorola-compatible products including the 6800, 6802 and 6809 8-bit microprocessors and the 68000 16-bit microprocessor, static and dynamic memory devices and EPROMs. It may be useful for those looking for information on Motorola products without going to the expense of purchasing a full Motorola data manual.

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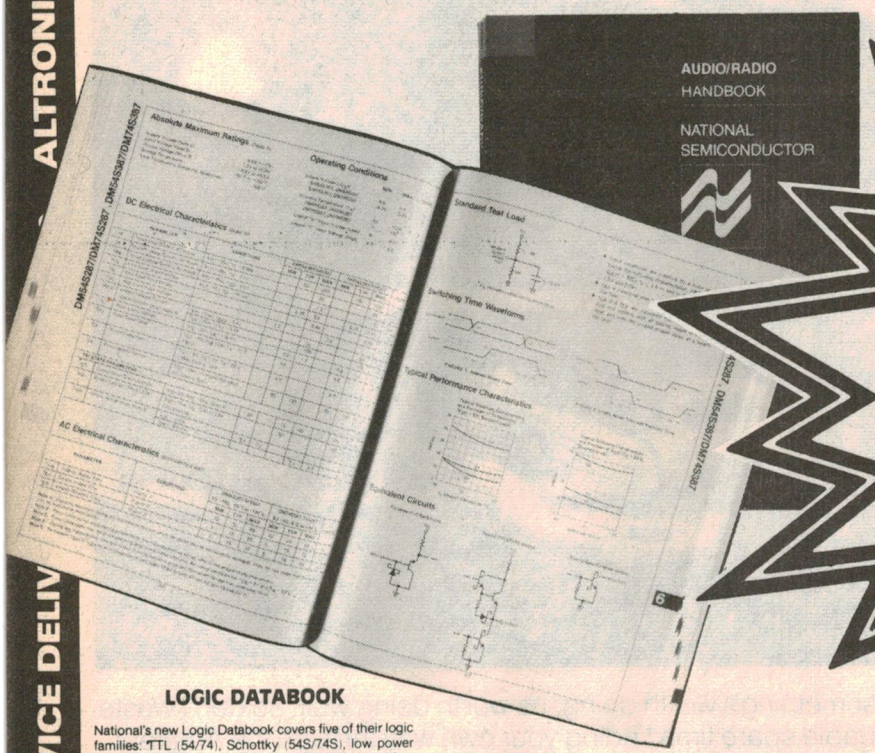

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REVIEWS OF RECENT Records & Tapes

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SHOSTAKOVICH No. 10: "not to be missed"

SHOSTAKOVICH — Symphony No. 10 in E Minor. Berlin Philharmonic Orchestra conducted by Herbert von Karajan. DGG Digitally recorded disc 2532 030.

Shostakovich wrote this symphony after 10 years of silence in this form in which he had previously been so prolific. Was it because, with Stalin safely dead, he could write just how he wanted to? At any rate his mood in this work was grim — tragically so.

Even the bright-sounding Finale has its sinister undercurrent and there is no overlooking the black tragedy of the first three movements. Why?

The war was victoriously over, the tyrant dead, the artistic atmosphere freer than it had been for years.

There is, of course, something tragic in the Russian soul, no matter what the mood of the moment. And even their jollity and humour is of the rough, rustic kind. There is plenty of sarcasm, but irony is practically unknown.

The eloquent record cover prepares the listener for what he will find inside: it pictures giant monumental initials, DS, carved in massive granite, standing upright against a flaming stormtorn sky.

The 10th is regarded by many, including the writer, as Shostakovich's greatest work. It is a giant symphonic structure, not in the Mahler manner of length but in its great emotional intensity.

There is not a bar's let-up in either rage or lament in the first movement. And that great orchestra, the Berlin Philharmonic, has never played better or responded with more complete obedience to von Karajan's direction. The latter has obviously studied the work with unremitting earnestness. It has no mysteries for him and he glories in exposing the whole spectrum of the work with the eagerness of a proselyte.

This is not to be taken as meaning that von Karajan was unaware of Shostakovich' greatness before meeting him in the 10th. I just mean to emphasise the completeness of the conductor's success in exposing every angle to his audience. The digitally recorded sound is always wonderfully clear, the range wide but reasonably so, the string tone a little hard. The symphony runs just under an hour.

The anger is ferocious, at times sounding as if the composer would smash anything in his path. Logically, the first movement ends in despair. But the ferocity is contained in the brief scherzo — undisguised brutality given rein, the anger expressing inexorable power. Even the rhythm is uncomfortably violent.

Shostakovich relaxes a little in the third movement but the tragic atmosphere persists, although not so violently. The feeling here is one of regret signed with his personal musical signature — DSCH — his name spelt the German way in musical notation D, E flat, C, and B natural. Although for the most part in waltz time, this is not readily recognisable. To me it called up a macabre image of dancing with a dead woman. dragging her limp form around.

The Finale opens sadly then goes on to a fast section pushed along so fleetly by Karajan that is reveals all the wondrous virtuosity of his band.

For Shostakovich lovers, not to be missed. (J.R.)

IVES No. 2: "Classical outline + quotes"

IVES — Symphony No. 2 Concertgebouw Orchestra conducted by Michael Tilson Thomas. CBS Masterworks, digitally recorded disc. CB331.

Under the frequent use of harsh dissonances and the multiple quotations of American popular songs and snatches of the classical lies a truly romantic spirit. Informed readers will recall that, not so long ago, this composer, who was also a rich businessman, was hailed, especially in America, as a pioneer who anticipated to a very great extent the atonal practices of the Vienna Second School — Schonberg, Berg and Webern.

I believe that these propensities were bequeathed to him by his eccentric father who insisted, whenever a band played outside their New England house, that his son Charlie play the main tune simultaneously on a trumpet — or more likely, a cornet — a semitone lower. Right ornery? Right!

At any rate young Ives had a whale of a time writing music with similar characteristics and so won immortality, while making a respectable fortune in business. But, judging by the shortness of their sojourn in record catalogues, he hasn't much staying power.

Ives was born in 1874 and lived 80 years industriously composing music like no one else's and building up a fortune in the insurance business. In the symphony under review, however, he reverted temporarily to classical outlines and practices, although this didn't prevent him awarding the work a goodly quota of quotations and well known phrases from the works of Beethoven, Brahms and other even more conventional composers and adding blaring brass interruptions from such popular ditties as "Turkey in the Straw"!

Reviews in this section are by Julian Russell (J.R.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.) Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

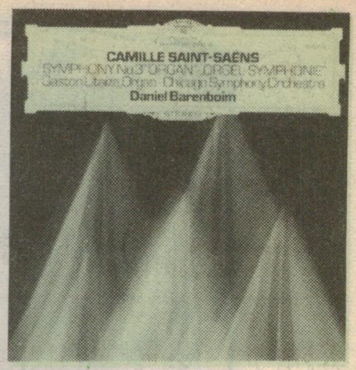
But, underneath all the ragged tumult, only thinly disguised, is a true romantic who had a whale of a time cocking a Yankee snook at his "betters". The Second Symphony is a watershed work, coming between his early extravagancies while a student at Yale and his later more individual utterances. It is one of his longest and most ambitious pieces.

As a transitional work, it exposes Ives' expert handling of conventional sonata form and Brahmsian-type writing for the orchestra. He also showed an easy mastery of such intricacies as polyphonic writing. But, even at this stage, he couldn't resist quoting such popular tunes as the Camptown Races, Massa's in the Cold Cold Ground, Columbia Gem of the Ocean and countless others, some blared out by the brass, others discreetly sneaked in.

What was the reason for these eccentricities, apart from the semitonal activities of his father? I think that, being the acute businessman that he obviously was, he appreciated early the value of originality as a form of self advertisement and so proceeded cheerfully to "epater le bourgeois."

At times, the usually sedate if brilliant Concertgebouw Orchestra seem a little bemused by all this foreign ruckus but deals manfully and for the most part successfully with the musical cannibalism. And conductor Thomas is there to guide them on this exotic tour. As to the composer's fate, well, he achieved enough kudos to have a Charles Ives Society formed in his memory! (J.R.)

SAINT-SAENS No. 3 "ORGAN" SYMPHONY



SAINT-SAENS, Symphony No. 3 "Organ". Gaston Litaize, Organ. Chicago Symphony Orchestra, conducted by Daniel Barenboim. Stereo, D.G. 2530-619. Now released through the World Record Club as R-102 12.

The third and last of the symphonies actually published by Saint-Saens, this one, Op 78 "Organ" is normally considered to be the most imposing and possibly the climax of his creative life.

It was written for the Royal (then the London) Philharmonic Society and first performed in May 1886 in the presence of the Prince and Princess of Wales, later Edward VII and Queen Alexander. The performance brought criticism for composer for preferring a foreign premiere but the work nevertheless won ready acceptance in Paris during the following season, and has since enjoyed lasting popularity.

The work contains two major sections, although they are essentially subdivided. Side 1: Adagio, Allegro moderator, Poco adagio – 19'20". Side 2: Allegro moderato, Presto, Maestoso, Allegro – 14'50". It calls for considerable orchestral resources with extra woodwinds, an organ throughout and a piano with two players in the Finale.

The jacket notes offer no information as to the recording locale but the single word "(Synchronisation)" beneath the reference to the organ in the Chartres Cathedral gives the clue to what was in fact the case: the organ part was mixed into the recording electrically, and independently of the orchestra.

While this must have given cause for considerable apprehension at the time, one has to admit that the entry of the full organ on side 2 is sonically magnificent and the highlight of a work that is never short of drama. Indeed, this particular performance, which only ever came together on tape, has proved to be a very popular one with record buyers.

In terms of quality, I felt that the sound in the early stages was somewhat coarse but, later on, it improved to the point where I had to go back to check on my initial reaction.

Perhaps the truth is that, recorded in 1975/76, it isn't quite up to current expectations from the viewpoint of an '83 hifi buff. On the other hand, it's a performance that has earned considerable esteem and, if you're prepared to forgive a touch of edginess here and there, you could gain much pleasure from it. (W.N.W.)

HAYDN/VIEUXTEMPS "appealing to the ear"

HAYDN – Violin Concerto No. 1.
VIEUXTEMPS – Violin Concerto No. 5 Cho-Liang Lin (violin) with the Minnesota Orchestra conducted by Neville Marriner. CBS digital disc D37796.

When I was a boy – during the early part of this century – easily the two most popular violin concertos were the Mendelssohn and the Vieuxtemps No. 5 – both with performers and audiences. They are vastly different in style and content but share the advantage of being immediately appealing to the ear. Both have their dazzling bit in which the soloist can show off his or her virtuosity – although, on the whole, the Haydn sounds much the simpler work. The showy Haydn cadenzas were interpolated later and are not by the composer.

Apart from these cadenzas, the Haydn is easy on the player – which the Vieutemps is certainly not. It makes the coupling a little odd, unless the soloist wished to show his ability to deal with the spare classical (Haydn style) and the robustly romantic writing of the coupled work. In both exercises, the young violinist here emerges with great credit.

His history until now might interest readers. At 12 he arrived at the Sydney conservatorium and studied with Robert Pikler, where he got a very sound training indeed. In 1981, he graduated at the Juillard in New York, won international prizes and joined the chamber group that helped Isaac Stern celebrate his 60th birthday. This was done in chamber pieces and he later had other quite important engagements in other countries.

In any case he comes to this, his first recording, with confidence and good taste, able to differentiate the style of the two composers and acquitting himself excellently. He should face a bright future. Not unexpectedly, his age inclines him to prefer ever so little the romantic enticements of the Vieuxtemps to the barer structure of the Haydn but this is perfectly natural and only to be expected. Conductor and orchestra provide exemplary accompaniments to both works, that should have pleased his old master at the Con. (J.R.)

MAHLER: "LITTLE" 4th.

MAHLER – Symphony No. 4 in G major. Vienna Philharmonic Orchestra conducted by Claudio Abbado with soprano solo by Frederica von Stade. DGG digital recorded disc 2530 966.

Among Mahler's many great, but it must be admitted, sometimes inflated symphonies, the "little" Fourth stands out like a perfectly cut, brilliant jewel. It is a beautifully balanced work, almost conventionally symphonic in form, full of the joy of life and the innocence of childhood. And Claudio Abbado's Italian blood sees to it that its many expressive melodies are given their full entitlement of luxury.

It is warmer than Szell's which until now has been my favourite, but on only one occasion could it be called freakish. This is in the extra-slower-than-usual tempo he takes the opening of the adagio, marked by the composer "ruhevoll" (peacefully). True it picks up a little as it goes along but you need a little time to get accustomed to it.

Towards the end of this movement,

Records & Tapes — continued

when the "Wunderhorn" theme announces itself fortissimo, Abbado achieves a wonderful effect as if the passage had fallen on to the score before due and clamoured for inclusion. I can assure you that it is quite overwhelming.

The Vienna Philharmonic, used to treating long Brucknerian passages at a steady tempo, play like angels and make the whole sound perfectly natural and not a bit unusual. In this it is aided by digital recording of the finest quality.

One fault only might be attributed to my pressing – there is a sound like a deep scratch in the first movement and my pick-up remained in the same groove for several bars. At best it might have been caused by careless playing before the disc reached me but, to be on the safe side, check before you buy.

Frederica von Stade signs the Wunderhorn song in her usual lovely fresh voice, produces the low notes with utterly effortless ease, her barely heard pianissimo in the last stanza being something to wait for. Her childish innocence is just a trifle too obviously assumed but all such remarks seem niggling against the general excellence of the whole production, which I most heartily recommend. (J.R.)

AUDIOPHILE RELEASE

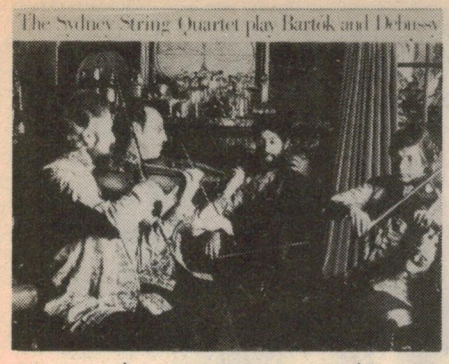
BARTOK – Quartet No. 5
DEBUSSY – Quartet. Sydney String Quartet. Cherry Pie (distributed Festival). Audiophile stereo disc LA 07721.

For some years, the Australian "Cherry Pie" label has provided a vehicle for some distinctive recordings, mostly by local artists. Many, indeed most, have compared favourably with overseas recordings in the same category. I regard them in much the same light as the ABC Classic label of Eric Clapham.

I have always felt that the rather frivolous-sounding Cherry Pie label may have disguised, to some prospective buyers, the deliberate nature of the contents. However, the new joint distribution arrangement through Festival should overcome this problem.

Now issued with the endorsement "Audiophile", the recordings have been re-processed on Festival's very modern equipment, including facilities for half-speed mastering. They are pressed on Festival's own virgin vinyl, handsomely packaged and sealed, appropriate for distribution both locally and overseas.

Some of Cherry Pie's artists have been unquestionably worthy of overseas ex-

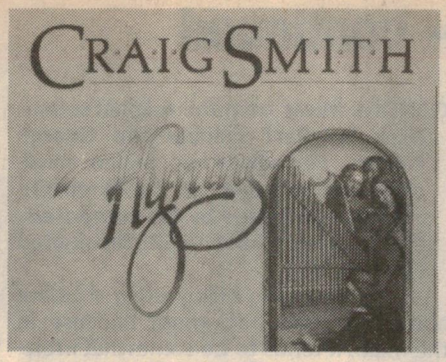


The Sydney String Quartet play Bartok and Debussy

posure, others not quite up to this standard. The Sydney String Quartet are in the first category and they are heard at their best in the Bartok Fifth Quartet on the disc under review.

It has vigour and accuracy and a true understanding of the difficult problems of its presentation. Newcomers will most certainly find it a hard nut to crack, especially at first hearing. So here is a tip to help:

Bartok uses clusters of themes where most earlier composers were satisfied with one. These he develops in all manners of ways, playing them backwards and forwards, upside down and right way up, augmenting and diminishing them, running them through the gamut of his instruments. If you take the two outside movements, both fast, and play them several times one after the other you will discover that they form mirror images of each other. The same applies to movements two and four, which are slow.



Admittedly this will be difficult without the aid of a score, which I urge you to get. The reason? If you turn a theme upside down, it may look very neat on paper but it will have an entirely new sound on the ear. It becomes, in fact, a new theme. Play the work, study the score, do this a few times, and Bartok's superb technique will become obvious.

I cannot be quite as enthusiastic about the Debussy. The players, except in the slow movement and the scherzo, seldom seem to realise a true French style. Nuancing is often a trifle overdone, the passion too unrestrained. Technically, no one could want more perfect unanimity of attack and release, or rise and fall of cadence. But it's all just that trifle overdone. A pity, because it has so much else going for it – in particular the leader's tone and feeling and the cellist's true understanding of what is needed of him, and very eloquently delivered.

The sound is comparable to the very best of overseas examples and I wish Festival/Cherry Pie well with their new enterprise. It should be a credit to Australia. From time to time other products from this source will be reviewed in this column. (J.R.)

TRADITIONAL HYMNS

CRAIG SMITH, HYMNS. With Chamber Orchestra, Men's Chorus and Boys' Choir. Stereo, Star Song Records SSR 0044. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.]

Although recorded only last year, using modern resources, this whole album draws its inspiration from at least a century ago, when many of the great hymns of the Christian Church were composed.

It begins with "Call to Worship" featuring the Angelus Bells, not in themselves musical but effectively turning the clock back to the period to which the whole program relates.

Craig Smith, tenor, provides the solo lead throughout but not in the manner of a featured artist, alone in the acoustic spotlight. The choirs, orchestra or organ are always there to fill in the

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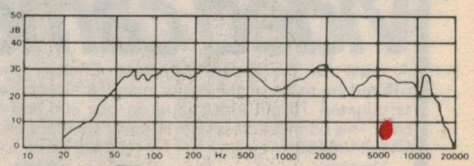
Measured response of Playmaster 300mm speaker system. Compare this performance with speaker systems you'd pay 3 or 4 times as much for.



Measurement performed by Dick Smith technical staff.

Acoustically designed by Neville Williams, MIREE (Aust.); retired Editor-In-Chief of Electronics Australia magazine, they feature a completely new format and style, starting with the strikingly handsome new grilles with the new 'Playmaster' logo - and ending with a performance you'd be amazed at !

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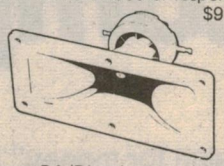

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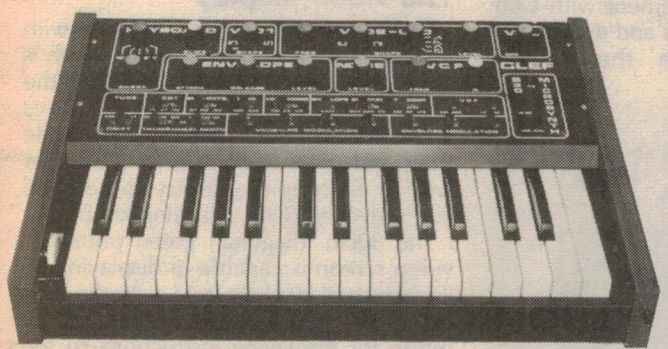

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Ref: EA Aug 1983

This project is very similar to the EA touch dimmer which has been very popular. Basically, you touch the wallplate and the light stays on for a predetermined amount of time. The same wallplate is used as the dimmer.
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This device can be made to fit inside a TV set (or in a separate box if necessary). It basically enables you to connect straight into the video drive of your TV, turning it into a colour monitor. This means that the video signal from your computer, VCR, TV game etc., does not need to be converted to RF and go through the TV IF strip. You will be amazed by the clearer, sharper signal that has less interference! Notes on how to fit to various TV sets are included.
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NEW $2.95
Cat. XM-9010

The Cromemco C10SP is a complete, ready-to-run computer system, which comes with software and extensive user manuals. Shown here is the optional CST display stand and (on screen) the four available character sets.

Cromemco supplies disk drives in its own packaging to match the main processing unit. The standard drives are 13cm 80-track double-sided units, using a double-density recording format to provide 390Kbytes of storage per disk. The drives connect to a single port at the rear of the cabinet and the connector provided is designed for piggy-back connection of multiple disk drive units on the one port.

Power for the disk drives is provided from the computer unit, so there is only one power cord and one on/off switch for the system – a convenient feature. In two respects however the design of the C-10 falls short of optimum; the power switch is in an awkward position at the rear of the monitor cabinet, where it is obstructed by the piggy-backed connections of the disk drives, and there are no brightness or contrast controls for the video display.

A utility program on the system disk allows these display parameters to be adjusted from the keyboard, but using the program (called "Bright") requires saving the work in progress, calling in a new program and adjusting the brightness of characters and background using the cursor control keys and then restoring whatever file you were working with.

This arrangement is far more inconvenient than twiddling a couple of knobs.

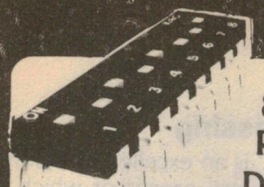
Diagnostics and a power-on self-test are incorporated in ROM on the C-10 circuit board, and are carried out each time the system is switched on, creating a noticeable delay (around 30 seconds) before the system is ready for use, but ensuring that any problems are identified immediately.

System configurations

Like most Cromemco products the C-10 is based on the Z80A microprocessor, running at a clock rate of 4MHz. 64K bytes of RAM is provided as standard, with 24K of ROM containing a resident operating system and machine

Cromemco C-10SP specifications

Processor:	Z80A at 4MHz
RAM:	64K
ROM:	24K
Keyboard:	Detachable, full-size 60-keys
Display:	Green phosphor, 80 x 25 lines
Interfaces:	Programmable printer port, RS232C communications port, Disk drive connection.
Disk drives:	13cm 80 track, double-sided, double-density, 390K storage per disk
Peripherals:	Parallel or serial printer, modem
Documentation:	Five comprehensive manuals, on-screen Help displays. Service and technical manuals are available separately.



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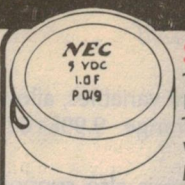

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4007	23c	7408	30c	7476	45c	74LS83	75c
4013	30c	7410	23c	7490	45c	74LS85	30c
4015	55c	7411	30c	7493	45c	74LS90	30c
4042	45c	7413	45c	74121	45c	74LS93	30c
		7414	45c	74LS11	23c	74LS123	30c
7400	23c	7420	23c	74LS12	23c	74LS157	30c
7402	23c	7430	23c	74LS14	55c	74LS174	30c
7403	23c	7432	23c	74LS15	23c	74LS240	75c
7404	30c	7440	23c	74LS20	23c	74LS245	90c
7405	30c	7442	45c	74LS27	23c		
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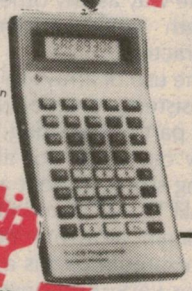

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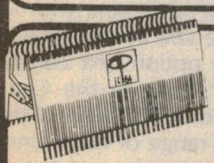

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own local variables which will not be affected by assignment statements outside the procedure, and will not affect variables of the same name in the main program or another procedure unless explicitly passed back or forward. Memory can be divided into eight partitions, each of which can contain independent procedures with variables local to that partition – a positive encouragement to modular programming styles.

SBasic also provides a line oriented editor to facilitate changes to programs and a cross-reference generator which will print out the names and values of all variables used in a program. Program listings are also automatically indented by the interpreter to indicate loops and other control structures in a clear and readable way.

Strings are handled as one-dimensional arrays, referenced by variable names of up to 31 characters. Before a string can be used it must be dimensioned, in the same way as any other array. The default length (without dimensioning) is 10 characters.

The use of arrays to store strings allows consistent, unambiguous references to any part of the string, and substitution of new characters for all or part of an existing string. Absent are statements such as LEFT$, MID$ and RIGHT$, replaced by a single array-oriented string specifier. An example of this approach would be:

Answer$=Response$(1,–5) (the first five characters of a string variable called Response$ becomes the variable Answer$) or;

Any$=Response$(1,10) (Any$ is assigned the characters from positions 1 to 10 of Response$).

New substrings can also be inserted into existing strings, as in:

New'string$(4,8)="abcde" (the string literal "abcde" is inserted into positions 4 to 8 of New'string$).

Although it takes a little time to become accustomed to this approach if you are used to Microsoft-style Basic ultimately the array storage of strings is more flexible, with the added advantage that all references to strings take a consistent form.

Other features of SBasic include an extensive range of output formatting instructions, easy access to both sequential and random access disk files (random disk I/O is greatly simplified by the fact that disk files can use exactly the same string format as Basic programs). The language also lends itself well to "number-crunching", with three numeric types; integer, short floating point and long floating point. Data values are automatically converted to the most appropriate format, with 14 digit precision for long floating point variables, allowing arithmetic in the range 9.99E+62 to 9.99E–65.

Matrix manipulation is also supported directly with the MAT statement and the interpreter will work either with radians or directly in degrees, selected by a MODE statement. To top it all off, the "semi-compiled" design and the 4MHz clock rate of the processor make the language very fast.

SBasic appears to answer many of the criticisms levelled against more conventional interpreters. It combines the clarity made possible by structured program design with the ease of use of a Basic interpreter, and is supported by one of the best manuals we have seen, a comprehensive 312-page spiral-bound book including examples of every statement and function of the language.

The Cromemco C-10 can be supplied in a "Superpack" configuration, the C-10SP, which includes software. On the system disk with the review unit were "WriteMaster", Cromemco's word processing package, "PlanMaster", a spreadsheet calculator, and "MoneyMaster", a program for analysing the economics of sharemarket transactions, real estate and capital equipment purchases. Also supplied was Screen, a text editor, a chess-playing program, and various demonstration programs.

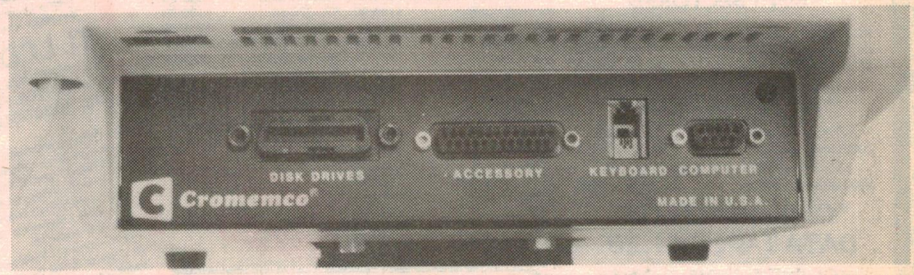
Word processing

"WriteMaster" is an excellent program, a full-featured word processor which is easy to use and to learn thanks to the entensive "Help" summaries and descriptions which can be called onto the screen from any point in the program. An array of 24 labelled function keys (the number keys, used with Shift and Control) contribute greatly to this ease of use.

A command menu is also a major feature of WriteMaster. On entering the program the available options are listed as Create (a new file), Edit (a previously created file from disk), Type (view the contents of a file), Print (for hard copy), Directory (to view the contents of the disk directory of word processor files) and Quit (leave the program without saving a copy of the text in memory).

After selecting an option text can be entered in the Edit mode or the Command mode selected with a press of the Escape key. A wide range of commands is available to select text for moving or copying, print the screen contents, a page of text, or a complete file, and to set margins and align text. Automatic pagination "find" and find and replace and mark text for inclusion in an index are also supported.

Many of the commands are quite long, such as "Boldface-selected-text", but on-



The rear of the C10 cabinet has connections for disk drives, printer, communication options, and of course, the keyboard.

Cromemco Structured Basic statements

ABS, ADR, ASC, ATN, AUTOL, BINADD, BINAND, BINOR, BINSUB, BINXOR (16 bit binary operations), BYE, CALL, CHAIN, CHR$, CLEAR, CLOSE, COMMON, CON, COS, CREATE, DATA, DDLIST, DEF FNS, DEG, DEL, DELREM, DIM, DIR, DO, DSK, ECHO, EDIT, ESC, END, END COMMON, ENDPROC, ENDWHILE, ENTER, ERASE, ERRPROC, EXP, FIND, FOR...NEXT, FRA, FRE, GET, GOSUB, GOTO, HEX$, IF...THEN...ELSE, IMODE, INP, INPUT, INT, IOSTAT, IRN, LEN, LET, LFMODE, LIBRARY, LIST, LIST VARIABLES, LOAD, LOCAL, LOCK, LOG, LONG, LVAR, MAT, MAX, MIN, NOECHO, NOESC, NOT, NTRACE, ON ERROR, ON ESC, ON GOSUB, ON GOTO, OPEN, OR, OUT, PARTITION, PEEK, POKE, POSE, PRINT, PRINT USING, PROCEDURE, PROTECT, PUT, RAD, READ, REM, REN, RENUMBER, REPEAT UNTIL, RESTORE, RETRY, RND, RUN, SAVE, SCR, SET, SFMODE, SGN, SIN, SPC, SQR, STOP, STR$, SYS, TAB, TAN, TRACE, TYPE, UNLOCK, USE PARTITION, USR, VAL, VALC, WHILE-ENDWHILE, XOR.

language monitor. There is no provision to extend the amount of memory in the system.

At the rear of the monitor cabinet are the connections for the disk drives (already mentioned), a keyboard connector and ports labelled "accessory" and "computer". The accessory port can be configured in software either as a parallel or serial printer interface, and a utility program allows the selection of one of nine types of printer. The Cromemco CLQ daisywheel printer is the default, but dot matrix types including the Epson MX80 are also supported.

The "computer" port is an RS232C serial interface which is used to connect the C-10 as a terminal, either via a modem or a hard-wired connection to another system. When the C-10 is switched on without a disk drive attached it will automatically enter a communications mode, sending a series of carriage return characters to establish the baud rate and format of the serial transmission protocol in use by the host system.

A major feature of the C-10 is its menu-oriented operating system. When first switched on with a system disk in the attached drive the computer comes up with a menu of nine functions, including word processing, spreadsheet calculation, or the "MoneyMaster" financial analysis program. From this main menu the user can select an "Advanced Functions" menu or a "Help" file which explains each of the options available.

The advanced functions menu offers options for copying files and entire disks, checking disk space allocation and printing files and a further display of Help screens. One of the options available is to leave the menu system and work directly with CDOS, the Cromemco Disk Operating System.

These two menus present some 20 options and function as the controlling "shell" of the operating system. CDOS commands and utilities which do not appear in the menus can be called up by typing the appropriate command name rather than a menu selection. Commands entered in this way return control to the menu when completed.

CDOS is said to be compatible with CP/M 2.2 in that the 27 system calls supported by this version of CP/M are also implemented in CDOS in the same way, so that most programs working under CP/M will also run under CDOS. Cromemco has added several refinements of its own however, including the menu system, and has renamed some of the other CP/M utilities. PIP, for example is gone, replaced by the XFER (Transfer) utility which allows files to be transferred between disks or between disk and printer or display console. An extensive manual is provided, with full details, including source listings of I/O drivers.

CDOS is entirely written in Z80 machine code by Cromemco for its own range of computer systems. While many programs written under CP/M will function under CDOS, the reverse is not true. The enhancements added by Cromemco will be primarily evident to the programmer wishing to work directly with the operating system and mainly provide new system calls to allow more flexible allocation of input and output to peripherals and disks. The built-in terminal driver and support for a hard disk are two examples of this approach.

Underlying CDOS is CROS, the Cromemco Resident Operating System. "Resident" is this case means that the operating system is contained in ROM. It is a machine language monitor which allows examination and alteration of memory, memory move and compare and execution of machine language programs. Low level disk operations and use of the C-10 as a terminal are also supported and the system self-test routines can be accessed. Two puzzling omissions however are the ability of CROS to set breakpoints or dump the registers of the Z80, both essential for debugging machine language programs.

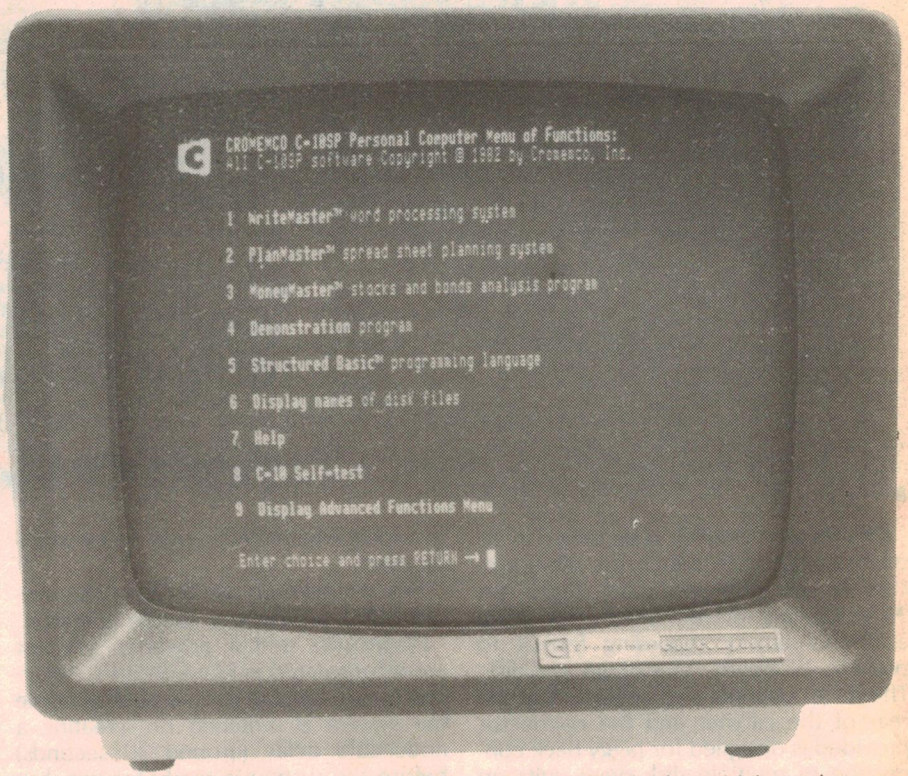
Structured Basic

Cromemco's SBasic should not be confused with the compiler of the same name running under CP/M, or Sanyo's version of Microsoft Basic, also called SBasic. The Cromemco version is an advanced interpreted Basic with features intended to overcome the deficiencies of more conventional implementations of the language.

Many criticisms have been made of the unsuitability of Basic for complex programs. The fact that all variables are "global" (can be referenced and reassigned from any part of a program) and the lack of control structures are two of the main criticisms. The lack of procedures which can be called from a library as required also prevents the use of modular programming techniques, essential to the creation of straightforward, understandable code.

SBasic overcomes these problems. Features include variable names up to 31 characters long, substitution of statement labels for line numbers (eg, Gosub Timeroutine is a valid instruction) and Repeat, While, If-then-else and Procedure statements in addition to Gosub and Goto.

The Procedure statement can be used to create a library of independent subprograms which can be called from a file on disk. Each procedure can have its



Shown here is the menu activated when the C10 is switched on. Main options are word processing, spreadsheet calculations, financial analysis, "Help" and "Advanced Functions".

The Cromemco C-10SP computer system

"Value for money" is the phrase which perhaps best sums up the Cromemco C-10 computer. The compact, up-to-date design of the system, the range of software provided and Cromemco's reputation for reliable, expandable products make the C-10 an excellent choice as a first computer for a small business or self-employed professional.

by PETER VERNON

Physically the C-10 is eye-catching, with a robust beige cabinet and brown trim, and closer inspection reveals some interesting features. In keeping with current thinking on user comfort the keyboard is separate from the computer, attached by an extensible cord similar to that used on telephones. However rather than providing a separate "logic unit" and a video monitor, Cromemco have chosen to mount the electronics of the system inside the cabinet of the display unit on a slide-out circuit board. Printers, disk drives and other peripherals are attached to ports at the rear of the monitor cabinet.

Our review unit was supplied with a stand for the video display unit which allows the screen display to be tilted and swivelled to suit the operator while raising it to convenient eye height. This stand is optional and may not be required by all users. In fact separately adjustable rubber feet on the monitor unit allow the viewing angle to be adjusted over a more limited range without the additional expense of the stand.

The keyboard is diminutive, although with 60 full-size keys. It weighs less than 2kg and measures 330 x 180 x 55mm (width by depth by height at rear) sloping to a height of around 20mm at the front. There are no excess keys, just the standard typewriter complement with Control, Escape, Alpha Lock and a cluster of cursor controls, with the number keys along the top row used in conjunction with the Shift and Control keys to provide 30 user-definable function keys. A double row of labels above these keys indicate the functions they perform when running "WriteMaster", Cromemco's word processing program.

A separate software utility is provided to allow a segment of the keyboard to be redefined as a numeric keypad to assist the entry of numeric data.

Other features of the keyboard are a wrist rest, automatic key repeat and optional audible feedback. An operating system utility allows the repetition rate of the keyboard to be varied and enables the audible response. There is no provision for varying the duration or tone of this reponse, and we found it to be both piercing and too long. The keys have a slightly heavy action, with no sign of contact bounce, and the keyboard is light and compact enough to be positioned to suit the user.

The compact detachable keyboard of the C10 is clearly laid out and easy to use. The labels at the top refer to functions provided by the number keys in Shift and Control combinations.

The video display

Our review system was provided with the "CST" tilt and swivel stand, which is an optional extra. Without the stand the video monitor/computer unit measures 300 x 405 x 280mm (W x D x H), while the stand raises the height to 420mm as well as allowing the display to be tilted and swivelled (with a locking knob).

The 30cm (diagonal) green phosphor video screen is capable of displaying 25 lines each of 80 characters, with the 25th line most often used in the half-intensity mode for displaying instructions to the user. Characters are steady and easily readable, on a true non-glare background, with special features including half-intensity, reverse video and on-screen boldfacing and underlining.

Four character sets are available, including standard ASCII and the same set in boldface, scientific symbols and graphics characters. Careful use of the graphics character set allows displays with a resolution of 160 x 72 (horizontal x vertical) but the Basic interpreter provided with the C-10SP has no specialised graphics statements.

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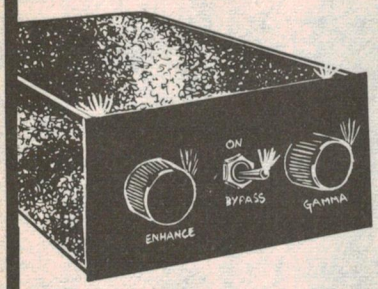

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VIDEO STABILISER

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WARNING! The AV6502 is intended soley for the use above.
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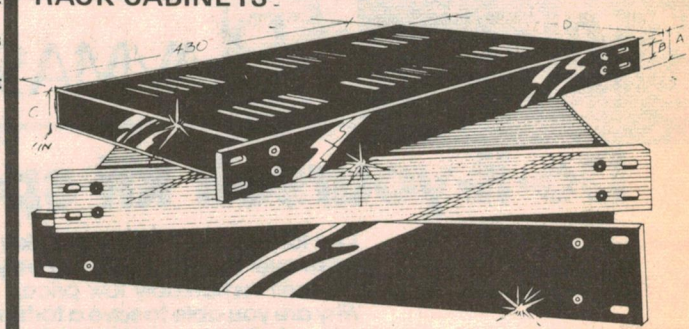

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Basically the same comments as above except that this cable has an in-line 14 pin plug and 14 pin socket for use with BETA type camera equipment. Again 10 metres long.
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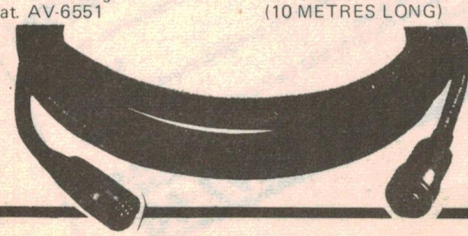

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LOW COST COAX ANTENNA SWITCH. . .
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background, focusing attention on the music and the message, rather than the performer.

Side 1 contains "Holy, Holy, Holy" and "When I Survey", followed by a suite combining "Jesus, the Very Thought of Thee", "Jesus, Lover of my Soul" and "Alleluia, Sing to Jesus". Then follows "Jesus, We Do Worship Thee". All these use traditional tunes and text, which are identified in the title listing.

On side 2 is "A Mighty Fortress" and another suite combining "Oh God Our Help", and "Oh For A Thousand Tongues To Sing". A single track follows "Now Thank We All Our God", and a final "Passion Suite": Passion Passicaglia (instrumental), "O Sacred Head Now Wounded", "Praise To The Lord", and "Crown Him With Many Crowns".

As you will doubtless have gathered, the whole aim of the presentation is to involve the listener in a communal experience of praise and worship. It is traditional and formal, yet not rigidly so.

An American production, the strings and, I suspect, the organ are post mixed but with no hint of artificiality in the sound. The album should appeal to those who like the great old hymns, presented with just enough of the modern flair to add interest. (W.N.W.)

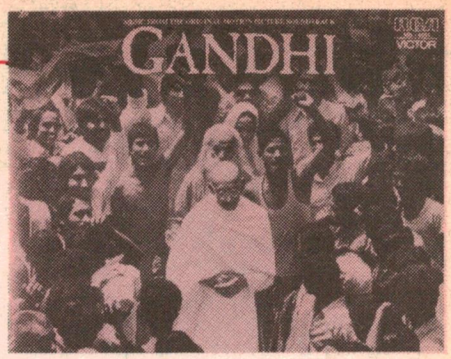
GANDHI. Music from the original soundtrack, by Ravi Shankar and George Fenton. Performed by Indian musicians and members of the Wren Orchestra, conducted by the composers. Stereo, Victor ABL1 4557. Distributed through RCA.

I must confess to being rather diffident about film soundtrack music because, in the main, it tends to be somewhat irrelevant outside the context of the film.

But, despite this remark, I found the music on this album to be quite arresting and a positive incentive to see the film itself. Perhaps it is that, even before the Gandhi era, India and the British Raj had featured so prominently in English history and fiction that, for many of us, memories and emotions can readily be awakened.

Sufficient to say that, having put so much effort into the visual side of the film, Producer/Director Richard Attenborough was determined that it should not be let down by the soundtrack.

With the filming virtually complete, he accordingly sought the assistance of Indian composer and sitar virtuoso, Ravi Shankar, and of a rising English composer for stage and television, George Fenton. It was a good choice for, working together, they came up with a score



which caught the one-time pomp and elegance of the British Raj, blending it and contrasting it to the indigenous music of India.

Not only that, but they recorded it using separate groups of English and Indian musicians, directed and co-ordinated by the respective composers.

The main track titles are: 31st Jan, 1948 – Bands of the Raj – Discovery of India – Villages of Bihar – Massacre at Amritsar – Reflections of Early Days – Salt – Partition – End of the Fast – Remember This Always – For All Mankind.

Apart from its historical context, the album is notable for another quality: the way in which it projects parts of the music into the listening room. No special claims are made about the nature of the recording but the vividness of the sound contributes to the interest.

The music is probably too specialised to generate a lot of spontaneous airplay but my tip is that it will appeal strongly to those who enjoy the film and who may want the opportunity to relive it from time to time. (W.N.W.)

☆ ☆ ☆

CLASSICAL FAVOURITES IN DIGITAL Volume 2. Franck Pourcel conducting the London Symphony Orchestra. Digital stereo, EMI EMC-2733 now released through the World Record Club as R-09876.

If you like tuneful snippets from classical sources, this album could be for you. Read through the list of track titles and you'll see what I mean.

Also Sprach Zarathustra (Richard Strauss) – Sabre Dance (Khatchaturian) – Largo (Handel) – Czardas (Monti) – Golliwog's Cake Walk (Debussy) – Sicilienne (Faure) – La Danza (Rossini) – Lellac de Come (Galas) – Can Can (Offenbach) – Reve d'Amour (Liszt) – Valse Op 39 (Brahms) – Moment Musicale (Schubert).

I emphasise that they're all excerpts, some of them transcribed by the conductor, but they add up to about 40 minutes of pleasant and familiar, classically sourced melody.

As noted in the title par, this is from a digital master recording and, as such, of recent origin (1981). The quality is clean and well balanced and a good one to play for your friends. (W.N.W.)

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KIT FEATURES ☆ Sockets for all other IC's ☆ 1 x 2716 supplied — get started straight away ☆ Front Panel and Mains (SEC approved) transformer ☆ 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) ☆ DB 15 Plug ☆ Complete to last nut and bolt.

(See Review ETI AUGUST 1983)

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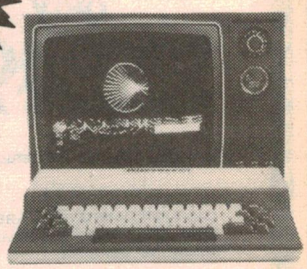

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A fully regulated and overload protected design, featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.
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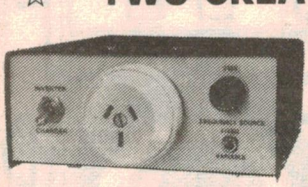

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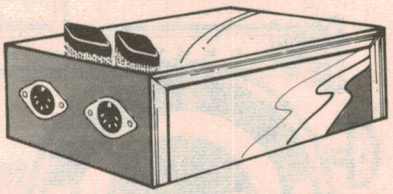

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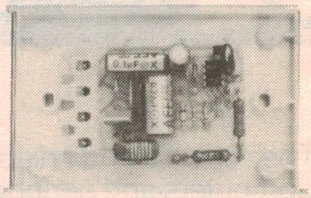

Great new kit from EA. (April '83). Based on new Seimens ICS576A Light Dimmer IC.
Instantly turn lamps on and off with just a light touch on a wall panel, or provide mood lighting by touching the panel for a few seconds.
The Altronics kit is complete in every way, including satin silver touch plates for that touch of class.

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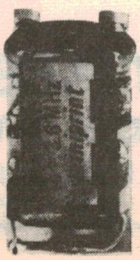

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Save a fortune on Fluoro Tubes.

- ★ Extends the life of your fluoro tubes by 1,000's of hours.
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K6300 (10UP$4.50) **$4.95**

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 117

ly enough of the command need be entered to distinguish it from other commands. For example, typing SA will result in WriteMaster displaying "SAVE" and "Is this what you mean?". An answer of "yes" or "y" will lead WriteMaster to prompt for the file name under which text will be saved to disk.

Single key commands can also be activated within the Edit mode by using one of the 24 dedicated function keys supported by WriteMaster. The numeric keys in conjunction with the Control and Shift keys provide access to editing functions such as boldface, underline, delete character, insert character, end paragraph etc. A cluster of cursor control keys on the right side of the keyboard allow movement within the text, although long movements are also supported by the commands "Next Screen" and "Back Screen" – again with dedicated function keys.

A feature of WriteMaster is a "merge" function which enables portions of text to be saved in a temporary file and called in from disk to be inserted in existing text. In addition to allowing large portions of "boilerplate" text to be incorporated in documents this option can be used for printing form letters or other documents.

At any time a summary or a full description of the functions available can be called up by typing HELP in the command mode or pressing the HELP key. These on-screen instructions are in addition to a comprehensive 306-page manual which includes a tutorial on using the word processor.

WriteMaster is a "what-you-see-is-what-you-get" style word processor. In addition to easy, full-screen editing and on-screen boldfacing and underlining, format commands work directly on the screen. Text can be aligned and justified, double-spaced or arranged in tabular columns in a fraction of a second, without the use of complex commands embedded in the text and with the assurance that it will be reproduced on paper exactly as it appears on the screen.

The only exception is "incremental" printing, Cromemco's term for proportional spacing. On the screen lines are justified right and left by inserting spaces between words. Cromemco's CLQ daisywheel printer can justify text more evenly by adjusting the spaces between individual letters in increments of 1/120th of an inch. (The printer is made in the United States, and like all printers and computer equipment is most easily specified in the old imperial system of measurement.)

With its extensive capabilities and features, WriteMaster is equally useful for the preparation of individual letters and reports, personalised form letters or long documents. It is an excellent complement to the power and flexibility of the C-10 computer system.

Spreadsheet calculations

"PlanMaster", Cromemco's spreadsheet program is just as flexible and convenient to use. Data values and formulas can be entered in any of 10 "pages" each of 12 columns and 30 lines (not including additional "columns total" and "lines total" areas). A command line, entered by pressing the Escape key allows entry of data, formulas, screen formats and line and column labels, printing spreadsheets and saving and loading files from disk.

The ubiquitous HELP file is available at any time from the command mode, in addition to an extensive 212-page manual incorporating a tutorial and full descriptions and examples of each command.

Options include recalculation on command or automatically when the spreadsheet is updated, selection of round-off or "dollar" format, exponential, decimal or hexadecimal notation. A range of control structures is available for complex calculations, including Repeat, If/Else and changing the page or the window displayed on the screen.

A range of other languages and applications are available to run under CDOS, including Fortran, Ratfor, Cobol and "C".

As we said at the outset, value for money is the key-note of the C-10. Cromemco has created a solid, reliable single-user computer system with software available for most of the tasks required by a small business, software developer or writer. Considering the features provided by the C-10 the pricing is attractive too.

By itself, the C-10 video monitor and processor unit costs $1710 including sales tax. A keyboard adds $277 to this price, providing a full-featured terminal for under $2000. The system reviewed here included two disk drives, but the single-drive C-10SP, including screen, keyboard, disk drive and the software discussed here is priced at $3059 (including sales tax). The tilt and swivel stand is an additional $269, and add-on disk drives are priced at $898 each.

For further information on the Cromemco C-10 contact Minicomp, 378 Forest Rd, Hurstville, NSW, 2220. Phone (02) 570 7233. In Melbourne: Adaptive Electronics, 418 St Kilda Rd, Melbourne 3000, Phone (03) 267 6800, and Informative Systems, 337 Moray St, (03) 690 2284, also distribute Cromemco products.

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Electronics Australia Personal Computers

MCC microcomputer training courses

As the microcomputer moves into the office the availability of training is emerging as a major issue. Advertising to the contrary, few people can set up a computer and go straight to work — a situation unfortunately exacerbated by the low quality and poor organisation of many hardware and software manuals.

While hobbyists may be willing to plough through cryptic manuals and consult books, magazines and users groups, business people and their secretaries have a more urgent need to find out how to make the best use of a computer in their activities.

One of Sydney's best known business training schools is the Metropolitan Business College, which since 1895 has been offering courses in secretarial practice. In 1979 the College established a data processing section, the Metropolitan Computer College, to answer the perceived need for commercially oriented entry level programmer's course.

The programming languages taught include COBOL, RPGII and Basic, and these courses focus on the needs of traditional data processing using mini- and mainframe computer systems.

At the same time an Office Technology Diploma course was introduced, combining secretarial and computing subjects to complement the Commercial Data Processing Diploma course, and word processing courses were developed using dedicated word processors.

The content of these courses is constantly under review to ensure that they meet the needs of the data processing industry and maintain an acceptable academic standard. The fact that the Diploma courses meet the stringent requirements set by the Australian Computer Society for accreditation is a proof of the effectiveness of this review process.

Two years ago, as microcomputers began to move into the office, the College began to assess the requirements for training courses focusing on personal computer workstations. The issues included questions such as which operating system would become pre-eminent and who would emerge as the premier software suppliers. Later in the planning process the College was forced to make a decision on which computer systems and software to support.

Recently the first results of this assessment and planning process appeared, in the form of courses to cater for the needs of users of microcomputers. The College selected WordStar, Multiplan and Attache accounting software as the likely front-runners among a welter of applications programs available.

The intent of the Metropolitan Computer College was to provide applications oriented education with significant "hands on" experience, with one machine for each student. Their hardware line-up, currently valued at over $300,000, includes the National Panasonic JB-3000, the IBM Personal Computer, NEC Advanced Personal Computer and the Toshiba T-300 business system.

Trained staff conduct the courses, specialising in one or other area of expertise. Four strands are currently available; an Introductory course, Attache Accounts Receivable and Inventory Control, Multiplan financial spreadsheet applications, and WordStar word processing. Comprehensive course materials complement the lectures, demonstrations and hands-on experience.

Both day and evening courses are available, typically running for 14 to 21 hours over three or four days or even-

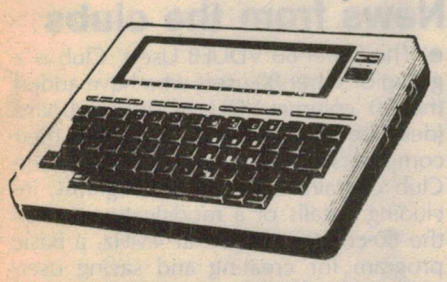
ings. In July, a voucher system was introduced. Available through computer stores, software suppliers, major retailers and directly from the College, the vouchers entitle the purchaser to time (in one day or two evening increments) on any MCC microcomputer course for which they are registered.

All the courses will be offered interstate by a franchising arrangement. Holmes Commercial College in Melbourne and Muirdens Business College in Adelaide have already begun teaching courses and discussions are currently taking place with colleges in Perth and Brisbane. In the near future, it is expected that colleges in other cities and major towns will also be represented in the scheme, providing a national network of uniform Australian courseware available through an Australia-wide voucher system.

Costs of the courses and registration procedures may vary slightly from state to state but as a guide the "Introduction to Basic Computing Concepts and Personal Computers", (7 hours over two evenings) costs $75. The WordStar word processing course is available in two forms, to suit those with previous word processing experience as well as newcomers. The "no previous experience" WordStar course over six evenings costs $255.

Further information can be obtained in Sydney from the Metropolitan Business College, Level 5, AMP Centre, 50 Bridge St, Sydney 2000 (02) 232 7666, or in Parramatta, 87 Marsden St, Parramatta 2150, Phone (02) 635 9533.

US release for Tandy portable computers



An interesting new portable computer, the Model 100, has been introduced in the United States by the Tandy Corporation. It is not yet known when the machine will come to Australia, but it is certain to prove a strong contender in the portable computer marketplace.

Features of the new portable computer include a full-size 56-key keyboard and a 40-character by eight-line liquid crystal display. The Model 100 uses a CMOS version of the 8085 microprocessor and comes with Microsoft Basic in ROM and 8K or 24K of RAM, expandable in increments of 8K to a total of 32K. Also in

Tandy portable computer . . . from p.137

ROM is an array of software, including a word processing program, appointments calendar and filing system, an address and phone number file, and a telephone and modem data communications program.

The system operates from batteries or an optional AC adapter and can store programs and data for up to 30 days between uses. A 300 baud direct connect modem is also built-in, allowing the Model 100 to be used as a remote terminal or for communication with database services.

Dimensions of the unit are 300mm x 215 x 50mm (W x D x H) and weight is less than 2kg, ready for use.

A parallel printer interface and RS-232C serial interface come as standard, as does a bar-code reader input and a cassette interface. Memory expansion modules, an acoustic telephone coupler and cables are available as options.

Radio Shack in the United States are advertising the Model 100 as "The Micro Executive Workstation". The portability of the system and the comprehensive range of built-in software are certain to appeal to many business and professional users, but it remains to be seen whether the unit will be approved for use in Australia. The stumbling block may be the need for Telecom approval of the direct connect modem.

Plato educational software for the TI-99/4A

The PLATO series of educational programs, originally designed to be run via terminals to a mainframe computer, will shortly be available on disks for the TI 99/4A home computer. An exclusive agreement between the supplier, Control Data, and Texas Instruments will bring PLATO to a large number of users at a fraction of the cost of participating in a time-sharing network.

TI Plato software packages will be available in the series to cover the teaching of reading, mathematics and grammar for grades 3-8 and maths, science, social studies and reading and writing for grades 9-12. The 108 PLATO packages available consist of 64 "Basic Skills" packages for younger users and 44 packages in the "High School Skills" segment, providing a total of over 450 separate programs.

The first package to be made available is a solid state program cartridge containing an interpreter and a set of disks with a survey to help parents or teachers select software for individual needs. The first program is also designed to teach keyboard skills to new users.

Use of PLATO software on the TI-99/4A computer requires a TI peripheral expansion unit, memory expansion board and a disk drive and controller card. For further information contact Texas Instruments Australia Ltd, Consumer Products Group, 6-10 Talavera Rd, North Ryde, NSW, 2113. Phone (02) 887 1122.

Perils for lawyers in new technology

Many lawyers, it seems, do not under stand new technology, but when faced with a case involving computers will go ahead on their own rather than seeking advice from a specialist – often with disastrous results. According to Miss Jane Levine, a senior lecturer in Law at the University of NSW, computer technology has created a maze of legal "booby-traps" for lawyers and for those involved in the computer industry.

Addressing a recent meeting of the NSW Society for Computers and the Law on the problems of contracts for computer sales, Miss Levine stated "I've seen many contracts which demonstrate a complete lack of understanding of new technology. The risks are enormous". Lawyers who practice in the computer field without fully understanding it risk making themselves liable to damages, she said.

The University of NSW has for the past four years run a course for law students which teaches the use of computers and looks at the legal problems created by new technology. There are many problems posed by the rapid growth of the use of computers and the slow rate of change of the law. "For example, there is no crime that covers the theft of computer time" says Miss Levine.

Another trap for computer suppliers, she says, is declaring that a personal computer is suitable for use in the home. Bringing the computer system within the definition of "consumer goods" may bring it under the jurisdiction of the Trade Practices Act, which contains regulations which may override any exemption clauses in a standard contract of sale for a business system.

News from the clubs

● The Super-80 VDUEB Users' Club is a group of Super-80 users who have added the 80 column VDU expansion board (described in EA March 1983) to their computers. The first newsletter from the Club contains advice and programs, including details of a modification to run the 80-column system at 4MHz, a Basic program for creating and saving user-defined graphics, a memory test program, modifications for the Super-80 Editor/Assembler for the VDUEB and an inverse graphics routine.

For further information contact the Club at 15 Bray Court, North Rocks, NSW, 2151. Phone (02)871 8394.

● A TRS-80 Color Computer Users' Group meets on the first Sunday of each month at 1pm at 3 Errigal Place, Killarney Heights, NSW. Club activities include software distribution, computer upgrades and assistance to new users. For details contact Eugene Staker, 451 8060.

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- *5 cursor control keys, 10 editing function keys with 14-key numeric key-pad*

Communication
- *Code: 128 ASCII characters*
- *Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200*
- *Parity: Odd, even, mark, space*
- *Operating Mode: Full duplex, half duplex or block mode*
- *Interface: EIA RS-232C or 20-mA Current Loop*

SPECIFICATIONS

Emulation
- *LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT*

Screen Presentation
- *Display format: 24 lines x 80 characters*
- *Display unit: 12-inch, non-glare Green CRT*
- *Character type: 7 x 9 dot matrix*
- *Refresh rate: 50/60Hz*
- *Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols*
- *5 screen attributes: Blink, underline, blank, reverse, dual intensity*
- *Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor*

Editing Function
- *Cursor: up, down, left, right, home*
- *Insert character, delete character, insert line, delete line, erase to end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected.*

External Control
- *Power on/off*
- *Contrast adjustment*
- *Baud rate*
- *Parity and data format*
- *End of message*
- *Emulation mode*
- *Refresh rate*
- *Half duplex or full duplex*
- *Auto line feed*
- *Auto new line*
- *EIA or 20-mA Current Loop*
- *Reverse video or standard video*

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- Cartridge Ribbon.
- Connectable to the many types of Computers for the Home or Office USE, also for OEM.

Specifications

1. Functional specifications

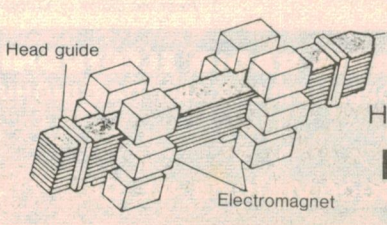
Printing method: Serial impact dot matrix. *Printing format:* Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit Image graphic — Vertical 8 dots parallel, horizontal 640 dots serial/line. *Character size:* 2.1mm (0.083")-W x 2.4mm (0.09")-H/7 x 8 dot matrix. *Character set:* 228 ASCII characters; Normal and italic alpha-numeric fonts, symbols and semi-graphics. *Printing speed:* 80 CPS, 640 dots/line per second. *Line feed time:* Approximately 200 msec at 4.23mm (1/6") line feed. *Printing direction:* Normal — Bidirectional, logic seeking. Superscript and bit image graphics — Unidirectional, left to right. *Dot graphics density:* Normal — 640 dots/190.5mm (7.5") line horizontal. Compressed characters — 1280 dots/190mm (7.5") line horizontal. *Line spacing:* Normal — 4.23mm (1/6"). Programmable increments of 0.35mm (1/72") and 0.118mm (1/216"). *Columns/line:* Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed/double width — 71 columns. The aboves can be mixed in a line. *Paper feed:* Adjustable sprocket feed and friction feed. *Paper type:* Fanfold. Single sheet, thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10"). *Number of copies:* Original plus 3 copies by normal thickness paper.

2. Mechanical specifications

Ribbon: Cartridge ribbon (exclusive use) black. *MTBF:* 5 million lines (excluding print head life). *Print head life:* Approximately 30 million characters (replaceable). *Dimensions:* 377mm (14.8")-W x 295mm (11.6")-D x 125mm (4.9")-Hincl, sprocket cover. *Weight:* Approximate 5.3Kg. (11lb). *Power requirement:* 100VA max. *Temperature:* Operating — 5 to 40 degree C (41 to 104 degree F). Storage — minus 30 to 70 degree C (−22 to 158 degree F). *Humidity:* Operating — 5 to 90% RH, no condensation, Storage — 0 to 95% RH, no condensation. *Shock:* Operating — 1G (less than 1 msec). *Vibration:* Operating — 0.25G, 55Hz max. Storage — 0.5G, 55Hz, max. *Insulation resistance:* 10 Meg ohm between AC power line and chassis. *Dielectric strength:* Between AC power line and chassis, AC 1KV (RMS) 50Hz or 60 Hz, during one minute and no abnormal condition shall be observed.

3. Interface specifications

Interface: Standard Centronics parallel. Optional RS-232C. (SERIAL). *Data transfer rate:* 4000 CPS max. *Synchronization:* By external supplied STROBE pulses. *Handshaking:* By ACKNLG or BUSY signals. *Logic level:* Input data and all interface control signals are TTL level.



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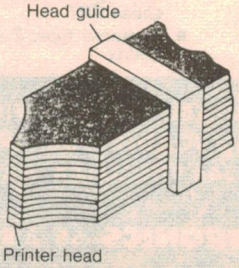

SERIAL $695.00
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Dealer and Bulk enquiries welcome.

NB: Printers are slightly different to the photo.

Teleconferencing meets resistance

"Serious and surprising obstacles" are preventing the rapid growth of "teleconferencing", according to a new research report from International Resource Development Inc.

According to IRD, a persistent theme in teleconferencing experiments is that users are not comfortable with the technology, or find that it does not really convey the "presence" of remote conference participants. Perhaps, say IRD researchers, the major problem is the cultural expectations generated by the use of TV-like screens.

Contrasting the professional production of television with "teleconferencing", what comes across is an appearance of incompetence or slovenliness. "To their dismay, some executives find that teleconferencing portrays them as nerds," says Ledecky. Not surprisingly, they become reluctant to use the medium.

Compumuse . . . *From p99*

Lines 510 to 600 of our program calculate the noise control byte from the options selected. The only remaining step is to calculate the volume control byte in the same way as for the tone generators.

The noise source volume control register has a base address of 240, made up of a most significant bit set to 1, and a three bit register address field with all bits set to 1. The value of 240 corresponds to maximum volume of the noise source (minimum attenuation). Specifying volume as a number between 0 and 15 and then subtracting it from 15 before adding it to the base value gives us the required volume control byte in line 650.

Again the user has the option of hearing the sound produced. Producing the sound is a matter of first sending the control byte, specifying the type of noise and its pitch and then sending the volume control byte to enable the noise source. You could of course do it the other way around, but if the noise source is enabled first you will hear noise based on the previous contents of the control register during the short time before the noise control byte is updated.

Note that the program in listing 1 is an aid only, not a demonstration of the capabilities of the sound generator. By noting down the register values and control bytes required to produce a particular tone or noise and combining these values in your own programs a wide range of sound effects can be created. Listing 2 demonstrates some of the possibilities but there's no need to stop there.

The Preh Commander keyboard

Mayer Krieg & Co now has stocks of a new keyboard design, the Preh Commander, advertised as an "intelligent, programmable" unit. The 68-key alphanumeric keyboard is built around a microprocessor and allows the user to select parallel or serial output, with a positive or negative key pressed strobe pulse, serial transmission rates from 150 to 9600 baud, auto-repeat and caps lock, and over 200 different internal characteristics.

According to Mayer Krieg the keyboard is designed to the latest ergonomic standards, with dished keys and sloping from 35m at the rear to 10mm at the front of the keyboard. A metal frame gives rigidity while each key has a separate guide and a double spring, providing a bounce-free contact and reliable switching.

For further information contact Mayer Krieg & Co, GPO Box 1803, Adelaide, SA, 5001. Phone (08) 223 6766. Sheridan Electronics, of 164-166 Redfern St, Redfern, NSW also advertise the Commander keyboard. Phone (02) 699 5922.

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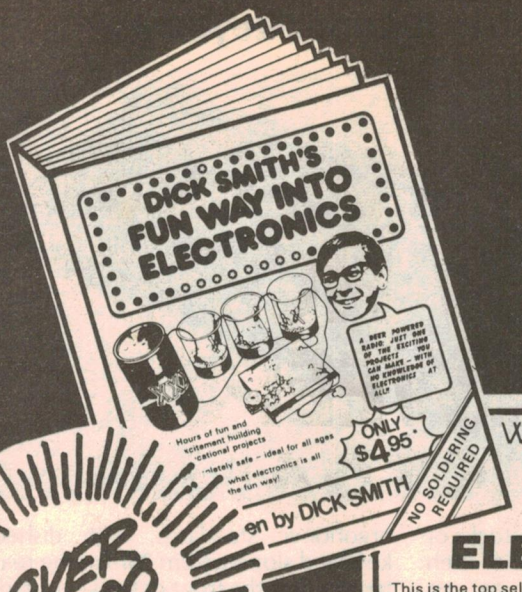

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ONLY $4.95

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This kit contains the slightly more specialised components which, together with the components from kit 1, will enable you to make any of the projects in the book. Cat K-2610 $7.90

PARENTS PLEASE NOTE

All Fun Way Into Electronics kits are battery powered so they are completely safe. Also, Fun Way Vol. 1 kits require no soldering.

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After mastering Fun Way Vol. 1 what better way to go than Vol. 2. In Vol. 2 you are introduced to printed circuit boards and soldering. Both are fully explained and illustrated and they give you the choise of making your own boards or buying ready made. The basic laws of electronics, plus chapters on component codes, assembly hints etc. are fully explained. ..... Cat. B-2605 $6.95

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SEE PAGE 98 FOR ADDRESS DETAILS

A383/CT

Sunday Observer
A Peter Isaacson publication.

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These devices, which can be purchased over the counter, encourage the invasion of privacy on a grand scale.

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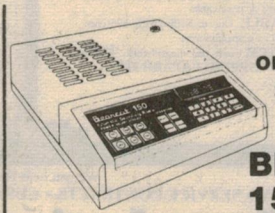
ONLY $349

The economy scanner with deluxe features: Extended frequency range, 16 ch. memory, priority and lockout capabilities, delayed channel access . . . and so much more! Incredible value! **Cat D-2801**



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BEARCAT 150

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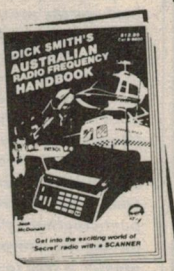

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Australian Radio Frequency Handbook

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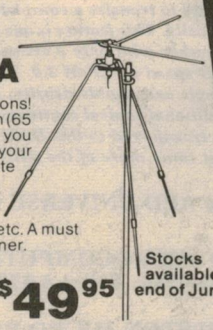

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DICK SMITH ELECTRONICS

See page 98 for full address details.

A501.CT

Jump From Program To Program

WORLD FIRST FOR AUSTRALIA

AED "UNIVERSE" HAS TECHNOLOGY LEADING FEATURES

Last month in this column we looked in depth at the Universe's unique office automation facility that for the first time allows a computer user to instantly gain access to his Mail List, Stock System, Debtors, Diary, Database, Word Processor, or any other CP/M end application. This capability is due to AED's "MPS" system that allows instant swap from program to program and back with complete screen maintenance.

This month we shall look more closely at two of the many other features of this advanced machine.

DUAL 8 AND 16-BIT CPUs

In the past the largest software base was offered by computers running the 8-bit CP/M operating system, nowadays however, CP/M-86 and MS-DOS are taking hold due to popular 16-bit microcomputers such as SIRIUS and IBM etc. The "UNIVERSE" cashes in on both the large software bases of the 8-bit CP/M and the superior speed and capability of the 16-bit MS-DOS operating systems. The UNIVERSE's CPU card comprises of a 6MHz 8085 processor combined with an 8MHz 8088 processor in a software selectable form. Thus the "UNIVERSE" is compatible with all popular 8 and 16-bit operating systems eg CP/M, I/OS, MULTI/OS, CP/M-86, MS-DOS, MPM-86 etc.

INTELLIGENT DMA FLOPPY DISK CONTROLLER

The UNIVERSE's floppy disk controller is perhaps the most technically advanced available. It employs its own 4MHz Z80 CPU and appropriate serialising hardware to perform the Disk I/O functions for up to 4x8" and 4x5¼" disks concurrently. The transfer of instructions and data to and from the controller is via a true DMA (Direct Memory Access) channel. Data can be transferred directly to any part of the 24 memory address line memory space of the S100 system. Once the controller is instructed, no further participation by the S100 master CPU is required during the complete sector or track transfer. The master is free to perform other functions with the DMA processor slowing it down by less than 10%. The controller consumes no space from the System Memory Map as a single output port is used to "kick" the controller whereby it picks up its instructions via the DMA channel.

FASTER: 6 & 8 MHz 8 & 16 Bit dual C.P.U.'s.
MORE APPLICATIONS: via CP/M, CP/M-86, MS-DOS, MULTI/OS, & MP/M-86.
HIGHER SPEED: 8" 1.2 MEG DMA Floppy & DMA 16 MEG hard disc fixed & removable.
MORE EXPANDABLE: Due to S100 IEEE 696 compliance from hundreds of manufacturers.
THE ONLY SYSTEM with the magnificent 'MPS' **INSTANT TASK SWAPPING CAPABILITY.**

SLOW: Non standard 5¼" discs.
SLOWER: 16 Bit only C.P.U.
LIMITED EXPANDABILITY: Cards from only a small number of manufacturers.
FEWER APPLICATION PROGRAMS: Due to 16 Bit only C.P.U.

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A unique feature of the controller is its ability to transfer a complete track of data directly into, or from, memory. Unlike other controllers, the sector headers are removed, or inserted, automatically. This feature is one of the contributing factors allowing AED to implement "MPS", which allows the user to swap from one CP/M program to another with only a six-second delay. This track read/write capability is extremely useful in systems employing "cache" buffering for greater disk I/O speed eg CP/M 3.0, TURBODOS, etc. The on board Z80 CPU is controlled by a 2K eprom which provides routines for single and double sided, single and double density, 8" IBM standard disks with fully automatic type switching. The eprom also contains routines for NORTSTAR 5¼" drive. Additional control routines can be down loaded into on board RAM from the master system via the DMA channels, and the control of the Z80 can then be transferred to this RAM.

Next month in this colum we shall look closely at some more of the AED UNIVERSE's Technology Leading Features.

For a complete information kit on the AED UNIVERSE Computer send a stamped, self-addressed A4 envelope to,

AED

Sydney: AED MICROCOMPUTER PRODUCTS, 130 MILITARY RD, GUILDFORD 2161. Phone (02) 681-4966. Telex AA70664.

Melbourne: ELSTON MICRO P/L, 53 WAVERLEY RD, EAST MALVERN 3145. Phone (03) 211-5542. Telex AA30624 ME447.

Personal computers

US market shake-up

Recent events have sent shock waves through the home computer industry in the United States, leading some observers to question the long-term viability of the market. Texas Instruments' recent announcement of an after-tax loss of $US100 million in its home computer division for the second quarter of 1983 and a price cutting war between distributors triggered a share market slide which affected all home computer manufacturers.

Fierce competition, leading to dramatic price cuts and rebates as retailers struggle for a share of the fastest growing equipment market in the United States has meant a bonanza for buyers. The Timex T1000 (ZX81) can now be purchased for as little as $US29.95, and TI's home computer, the TI-99/4A, is now selling at below $US100, after being introduced at around $US400.

It is unlikely that a crisis situation will develop in the computer market as a whole, given the basic strength of demand emphasised by IBM's sale of over 300,000 Personal Computers in 18 months in the United States.

Executives from Tandy Corporation and Commodore Computers refuse to accept that there is a general problem, blaming Texas Instrument's situation mainly on the company's own mistakes and miscalculations.

Perhaps two million under-$1000 microcomputers were sold in the United States in 1982 and analysts are predicting sales of around five million this year.

At the root of TI's problem is that it expects to sell only (?) two million home computers this year. A $50 rebate and heavy price-cutting has boosted sales but it can't be very profitable, except, of course, for the customers.

Solution for July

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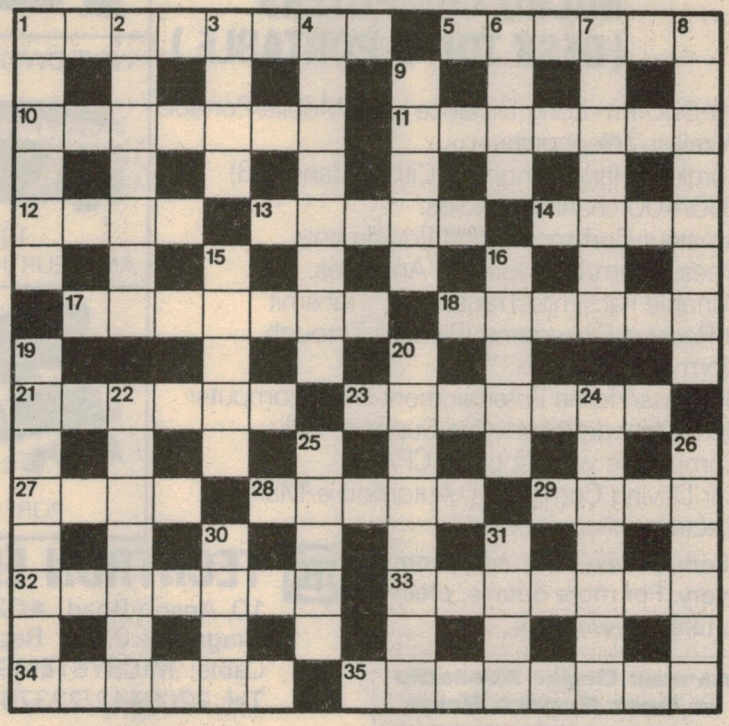
Electronics Australia

AUGUST CROSSWORD

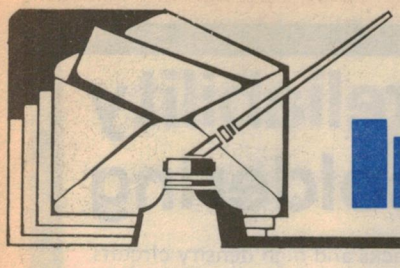


ACROSS

1. Periodic waveform used to provide a time base. (8)
5. Type of transformer. (4-2)
10. Top performance. (7)
11. Thermionic valve with seven electrodes. (7)
12. Bend in zener characteristic. (4)
13. Range of microwave frequencies from 36 to 46 gigahertz. (1-4)
14. Dissipation of power in coils. (4)
17. Type of network which attenuates evenly. (3-4)
18. Transducer. (6)
21. DC fluctuation sometimes evident after rectification. (6)
23. Imperfections. (7)
27. Specified physical quantity. (4)
28. Squeeze together for a fastening purpose. (5)
29. Unfasten. (4)
32. Demodulates a received signal. (7)
33. Set of impedances. (7)
34. Type of current. (6)
35. A bistable circuit. (4-4)

DOWN

1. What you get from 240VAC. (6)
2. Accumulator. (3,4)
3. Units of resistance. (4)
4. CRO sweep circuit. (4,4)
6. Recording material. (4)
7. Pulses of electromagnetic radiation. (7)
8. Factor which affects electric discharges in air. (8)
9. By-pass in a circuit. (5)
15. Brand of personal computer. (5)
16. Type of diode. (5)
19. Connected to earth. (8)
20. Device which provides computer input or output. (8)
22. Source of computer output. (7)
24. Popular, though dated, name for thin sheet of metal. (7)
25. Component of an electric motor. (5)
26. A connection, often temporary, of electronic circuits. (4-2)
30. Current mode switch. (2-2)
31. Tape deck key. (4)



Information centre

CHRISTMAS TREE LIGHTS: I have been reading EA for about 18 years now. In earlier times I built projects but now I find most everything is "home-computer" oriented. I have an idea for a good, popular project; how about a fantastic Christmas tree light display system.

Given the availability of semiconductor switching elements, fine cable, and coloured LEDs etc, I propose a project based on sequential switching of LEDs to effect a "closing/moving source" effect. The closing rate could be adjustable.

If such an idea is entertainable, an August/September project would allow hobbyists to build for this coming Christmas (D.K., Highton, Vic).

● Not a bad idea, that. Have a look at our December 1981 issue. This featured a Christmas tree light decoration which was basically a low speed four-way chaser. The project is low in cost at around $15 and uses readily available bits.

TAI AND CAR COMPUTER: My congratulations on an interesting and informative magazine. Having read the latest article about TAI, perhaps my experience may help avoid trouble for someone else. I installed your first TAI in my 1975 Holden and it worked well, but . . . The ballast resistance wire is folded up and taped (under the dash) in the middle of a wiring loom. I was lucky it didn't start a fire; it just blackened and melted the insulation around it and finally went open circuit somewhere in the middle. Obviously the coil can take the extra current, but the folded wire can't.

I mounted a few 10 watt resistors on a tag strip on the TAI lid and all is well. Would it be worth updating to your new design?

The car computer has caused a number of problems:

1. Gate IC5c was destroyed twice so I assumed the damage came via the ignition switch. A 9V zener and a .047μF capacitor across the 1kΩ resistor (via 82Ω to ignition switch) has cured the problem.

2. I made the following substitutions: a washing machine solenoid coil (with a brass bolt to cut down the output) for a distance sensor; 1μF ceramic capacitors instead of monolithic; a 74C00 for IC6 instead of a 74LS00 as specified; a 1.0μF capacitor at the input to IC5c (to lengthen the reset time); and a 10MΩ resistor across the crystal.

It still occasionally does not reset correctly and all data is corrupted at switch on (usually at least once a week).

Could you tell me if any substitutions listed above have affected the reset, and how to cure the problem. Also, I could not get monolithic capacitors in Adelaide, or find out where to get them or why they are used! Can you tell me if the km readout can be changed to read 1/10ths of a km? (J.B., Eden Hills, SA).

(Continued on page 149)

Car Computer problems:

CAR COMPUTER: I would like to point out several design defects in the otherwise excellent Car Computer.

The first concerns the occasional failure of the system to initialise correctly. In my case, and I would imagine in every case, the display is blank and the system does not respond or run. This is due to the fact that when the 6821 PIA IC2 is initially reset, PA0-PA7, PB0-PB7, CA2 and CB2 are automatically configured as inputs. This allows pin 9 of IC6c to float high to about 1.3V and hence allows the NMI to run.

CB2 is not configured as an output and set low until the 32nd step of the program from reset and so every now and then an NMI occurs between the end of the reset period and step 32 of the program. This causes the program to loop between 605F and 607D with CB2 set low, inhibiting any further NMIs and also the display.

The problem is easily rectified by connecting a 10kΩ resistor to ground at CB2, thus holding pin 9 of IC6c low until step 32 is reached. In my case this gave a low voltage of 0.4V on reset and a high voltage of 3.01V on running and seemed the best compromise.

The second problem concerns the power dissipation of the 7805 TO-220 5V regulator, which in the Dick Smith kit was supplied without a heatsink.

The maximum average power dissipation of a TO-220 7805 with no heatsink is less than two watts at and above 15°C ambient. The current at reset is 750mA with all segments illuminated and the voltage drop across the regulator will be greater than eight volts for a normal alternator. This amounts to six watts dissipation in the regulator. In my case, a failure of the 74C14 (IC5) caused the system to remain reset and by the time I got around to fixing it, the solder had melted on the leads, even with the heatsinking I had added.

The normal operating current is of the order of 350mA, depending on the segments illuminated, and this amounts to a dissipation of approximately three watts. I would strongly advise externally mounting the regulator on a heatsink and using a 4.7Ω five watt resistor in series with the +12V supply. This will ensure at least the required 7V plus at the regulator with the reset current and a battery voltage of 11 volts. (R.B., Henley Beach, SA.)

● CB2 of IC2 controls NAND gate IC6c by going low shortly after the Reset. This prevents the display scan rate oscillator from causing an NMI before all initial conditions have been set up. A resistor to tie CB2 low before the program instruction sets it low after the Reset would, as you suggest, remove any possibility of this occuring.

Regarding the voltage regulator, a heatsink for the regulator was recommended in both the article and in the parts list. Operating the Car Computer without a heatsink will cause the regulator to shut down from excessive heat build up. While the dissipation during resetting of the computer is quite high, this lasts for a very short time and during normal operation the 3W dissipation is easily handled with the heatsink.

While the use of a series resistor will reduce the dissipation in the regulator, during engine starting the battery voltage can drop to 9V. This in conjunction with the voltage drop across the resistor may cause the regulator to drop out due to insufficient input voltage. Consequently we do not recommend this modification.

Choose ROYEL for high reliability soldering and desoldering

Power Unit Cat. ECT

Modern components, fine tracks and high density circuits are vulnerable to both excessive heat and voltage spikes. Royel equipment helps even highly skilled operators to avoid these problems and improve their soldering standards.

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- A larger tool, with 5mm tip dia. is also available.

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* FREE Z80 DISASSEMBLER with each MD (other disassemblers soon to'retrofit at low cost). Get a DISASSEMBLER LISTING of ROM in any microsystem!

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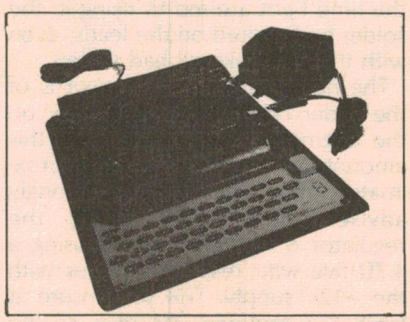
Z80 DEVELOPMENT SYSTEM

MENTA puts out a TV PICTURE of memory in hexadecimal. The 40 key keyboard will accept inputs, both in hexadecimal and Z80 mnemonics; there is a quick cassette data storage system, a powerful editor which permits program debugging by showing contents of registers and stack. Also there are 24 bits of I/O for external control. A Z80 disassembler is also available which outputs to any RS232 device such as a printer or terminal. MENTA was designed as a low-budget device for teaching microprocessing in schools: professional course-material is available to teachers together with add-on boards for a variety of control functions and robotic applications.



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INTELLIGENT EPROM PROGRAMMER

Good tools need not be expensive. SOFTY 2 is the latest version of the engineer's favourite EPROM HANDLER for anybody who uses 2516, 2716, 2532 and 2732 EPROMS. SOFTY will program any of these EPROMS or copy any type into another.
SOFTY puts out a TV picture of memory contents, with many code-manipulating and editing facilities. There is also a fast cassette data storage system. SOFTY is also a ROMULATOR (a lead is supplied which may be inserted into a board under development to emulate the ROM using SOFTY's internal RAM. This procedure can also be used on the single-chipper piggy-back type MPU.)
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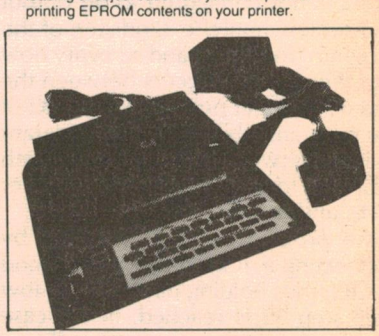

SOFTY 2 — $379.00

Castle ELECTRONICS **P.O. Box 311, Castle Hill NSW 2154. Ph. (02)634 7597.**

● If your existing TAI is performing satisfactorily there is probably little point in updating to the new design. Your idea of substituting for the loom ballast is a good one although up till now we have had no reports of the loom resistor burning out.

Regarding the Car Computer, we cannot see how the gate can be destroyed by the ignition switch since the diode at pin 5 of IC5c will block positive voltages. The modifications you have made should not affect the reset at turn on, although the 1μF capacitor at IC5c may not discharge in sufficient time before loss of power on powering down. We recommend the use of a 0.47μF capacitor.

We draw your attention to the errata notes in June 1983 which note the addition of a 10kΩ resistor at pin 9 of IC6c to ground.

Ceramic 0.1μF capacitors are satisfactory for use in place of monolithics. In fact monolithics are ceramic capacitors with a different internal structure which gives them their smaller size.

The alteration to 1/10 of a km resolution involves major software changes to the computer.

REMOTE INFRARED TV SOUND CONTROL: I have been interested for some time in a device to achieve the above, but was disappointed to find that it was such a sophisticated device. In my view, what is required is an automatic level control in the loudspeaker voice-coil circuit possibly designed around zener diodes. The remote setting of volume seems a superfluous function as remote control TVs have this feature already.

Many years ago I saw in an American magazine a scheme for what was called a "Hooey Eliminator" for application to broadcast receivers. This was in the form of an audio AGC and depended for it's operation on the differing power levels for music, and voice announcements, the gain naturally being up for music and down for speech.

In the TV sense, the only problem with sound levels of both music and speech is the higher power level of commercials. On two occasions over the years, I have rung television channels to protest at the level of the commercials, and have been told that the producers "pack more sound" into such recordings. Here then, is the answer, to produce a device to maintain a reasonably steady power input to the loudspeaker.

This could be preset at the usual listening level for the particular situation. In my experience the only variation to this is to turn the sound right off, during telephone calls, sporting results on the news, or the odd half-hour between shows. I feel sure that such a device would have an even wider appeal than the infrared device and be easier to apply. (M.S., Lane Cove, NSW.)

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CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value plus 30c for post and packing for each issue. Seven months and older, $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

● We agree that remote setting of the volume is superfluous if you have a remote control TV but then it was not intended for use with such TVs. We can see no practical way of providing an automatic volume control which will deal successfully with highly compressed advertising sound. For most people a remote control volume is the best solution.

ROTARY ENGINES: Can you advise on the fitting of electronic ignition to rotary engines? Are two units required and would they show any improvement in performance or economy? (C.J., Parkville, Vic.)

● Since rotary engines have two sets of coils and two sets of points, two separate electronic ignition systems would be required if a conventional transistor assisted circuit was used. However, some people have reported worthwhile results with a single TAI system fitted to the plugs which fire first in each chamber. We have no documented results.

A different approach would be possible if a capacitor-discharge ignition system was used. In this case it would be possible to have a common inverter circuit charging separate storage capacitors, one for each coil, via isolating diodes. Of course, separate triggering networks connected to each set of points would be required, as would two separate SCRs.

Whether or not CDI systems are advisable for rotary engine we cannot say. While we assume that "cross-fire" is not a problem, the short spark duration may be a drawback. Can any other readers advise on this subject?

HI-FI AM TUNER: I intend to build your "Hi-Fi AM Tuner" which was described in the December '82 and January '83 issues. I have no interest in purchasing a kit from any of your advertisers because I have my own requirements for housing the unit when complete.

Accordingly, I will obtain individual components from the various stockists and/or use components that I already have available. At this stage, I have purchased a set of PC boards and completed the digital readout – it works well and is currently installed with some other equipment.

I am now enquiring about components for the main tuner board and am fortunate that I have not expended any cash at the present time! All components can be purchased now except the CA3100 wide band op amp. No parts stockists in South Australia have heard of this device.

Can you advise where I can buy this component or is their any suitable substitute?

In the meantime, my old "R & H" wideband tuner which I constructed in 1961 will remain in service in my hifi system, complete with its Efco straight line dial, "Q-PLUS" wideband coils and 1.9MHz IF transformers and 6AN7 and 6BA6 "valves".

Incidentally, I overhauled this tuner a few years ago when all broadcast stations were changed to 9kHz spacing, ie, new valves and a retune of the whistle filter coil. It should be good for another 20 years as my wife likes the straightline dial with stations marked thereon but I think she will accept a digital readout in the future! (W.V., Flinders Park, SA.)

● Although they presently supply the complete tuner kit, Jaycar Pty Ltd have indicated that they will make the CA3100 available as a stock item.

Also, it is possible to purchase the IC by mail from AWA Microelectronics, 348 Victoria Road, Rydalmere, NSW 2116. The charge is $4.72, including sales tax. There is no readily available substitute for the CA3100.

EA marketplace EA marketplace

FOR SALE

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ADMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list send 105 x 220 SASE to: RJ & US Imports, PO Box 157, Mortdale, NSW 2223. Business closed during October.

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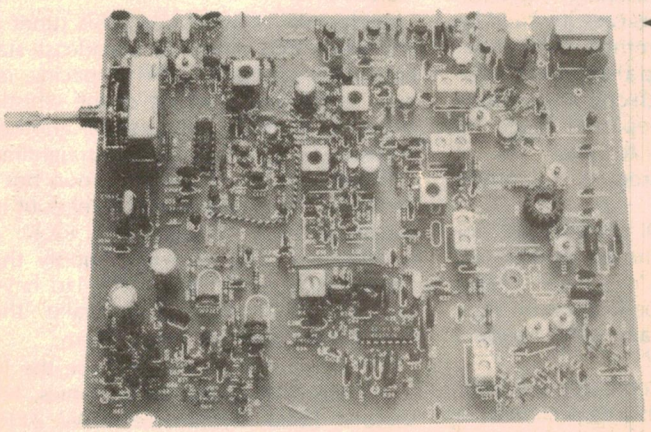

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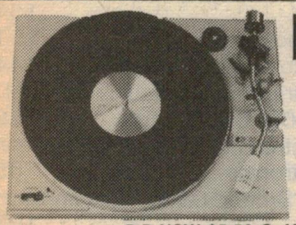

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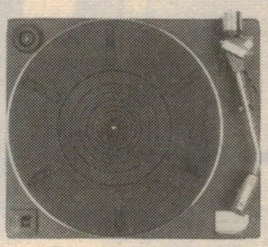

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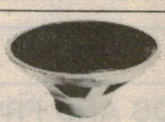

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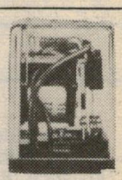

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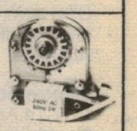

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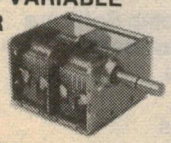

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Prices including postage are:

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Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

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Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Electronic Agencies,
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Concord, 2137.
Telephone 745 3077.

117 York Street,
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Telephone 29 2098.

Jaycar Pty Ltd,
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Telephone 264 6688.

Radio Despatch Service,
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Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

Rod Irving Electronics,
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Northcote, 3070.
Telephone 489 8131.

Kalextronics,
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Heidelberg 3084.
Telephone 743 1011.

Shop 11,
Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
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MacDougal Road,
Sunbury 3429.
Telephone 744 2714

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Perth 6000.
Telephone 328 1599.

Jemal Products,
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N.Z.

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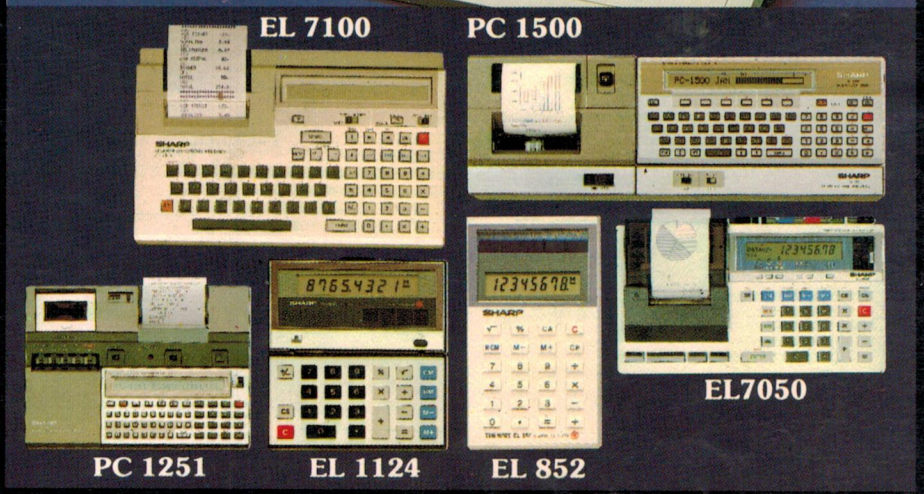

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